

SEP 8 1941

# AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

SEPTEMBER 1, 1941



*F*rom husky aircraft engine bearings to jewel-like midgets  
for sensitive instruments, every New Departure is the product of  
more than half a century of experience in precision manufacturing.

**NEW DEPARTURE**  
**BALL BEARINGS**

# **STOPS RUSTING OF MACHINE AND IMPROVES FINISH WITH**

## **SUPERLA**

● RUSTING was just one trouble this plating company had on the forming machine illustrated. Unless the paste compound being used was cleaned from the machine frequently, it left a resinous-like deposit that was difficult to remove. Fine lines on the finished work were also objectionable.

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## **SUPERLA SOLUBLE OIL**

## **STANDARD OIL COMPANY (INDIANA)**



# AUTOMOTIVE INDUSTRIES

*The* **AUTOMOBILE**

Reg. U. S. Pat. Off.  
Published Semi-Monthly

Volume 85

Number 5

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IN "Hottest"  
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International News Photo

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**LONGER HOB LIFE**  
is reported by Ettco  
Tool Co. in hobbing  
these helical pinions,  
for use in Ettco-Emrick  
Tapping Attachments.

**YOU'LL CUT  
BETTER GEARS**

**Y**OU CAN CUT GEARS which will operate easily, smoothly, quietly . . . when you cool the hob and the blank with **TEXACO SULTEX CUTTING OIL**.

The use of Texaco cutting coolants assures you of greater output, correct tooth form, better finish, longer hob life because it cools both the tool and the work, thus preventing chip welding.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred also in the metal cutting field.

These Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing plants in the 48 States, or write:

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★ More Diesel horsepower on streamlined trains in the U.S. is lubricated with Texaco than with all other brands combined.

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★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

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**FOR THE METAL WORKING INDUSTRY**

**RETURN METAL DRUMS PROMPTLY . . .** thus helping to make present supply meet industry's needs and releasing metal for National Defense.



## AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 85 September 1, 1941 Number 5

### Rubber Consumption Declines During July

Reflecting the conservation order of OPM, July consumption of crude rubber by American rubber manufacturers dropped to 68,653 long tons, a decrease of 19.1 per cent under the record June figure of 84,912 long tons. However, July of this year exceeded the same month in 1940 by 42 per cent.

Gross imports for July totaled 97,081 long tons according to the Department of Commerce. This represents an increase of 50.3 per cent above June, and is 39.5 per cent over July, 1940.

Total domestic stocks at the end of July, including Government reserves, totaled 395,216 long tons. This is 16.5 per cent above June and 125 per cent over the stocks estimated for July 31, 1940.

Stocks in the hands of the U. S. Government July 31 were 218,844 long tons, an increase of 6.2 per cent over June of this year. Stocks afloat for United States ports on July 31 were 132,304 long tons.

Reclaimed rubber consumption during July totaled 21,725 long tons; production, 23,111 long tons; and stocks on hand July 31 were 36,751 long tons.



### Million Dollar Program

15

During the past two years more than a million dollars have been spent to make the Cummins Engine plant the foreword for efficiency and accuracy. Pictures galore with text and sample routings of parts through the plant give the reader a most complete realization of what has been done.

### Speed Regulators for Dynamometers

26

In fan tests and fuel tests it naturally is desirable to hold the dynamometer at a constant speed. Here the subject is treated authoritatively with ways and means fully explained in text and diagrams.

### 1942 Packard

30

Clipper styling marks the new Packard line. Of course, this is not the only change, so you had better read the article.

### Hudson for '42

31

The Drive-Master highlights the new Hudson offerings, but there are a number of other changes that should interest you.

### High Speed on Defense Production at Timken

32

At this plant the order is all out for defense, and no stone has been left unturned to make it effective. It is a veritable beehive of activity. System and order are paramount in spite of the extreme pressure that has been placed on orders for the fighting units of the country.

### Men and Machines

38

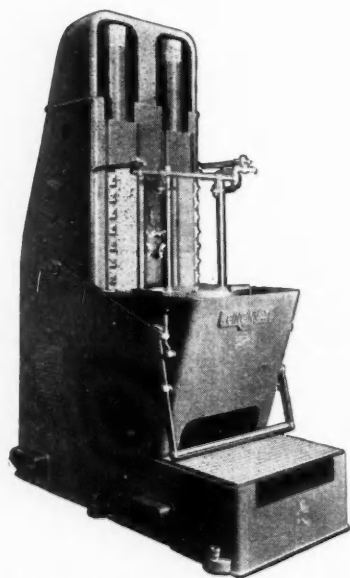
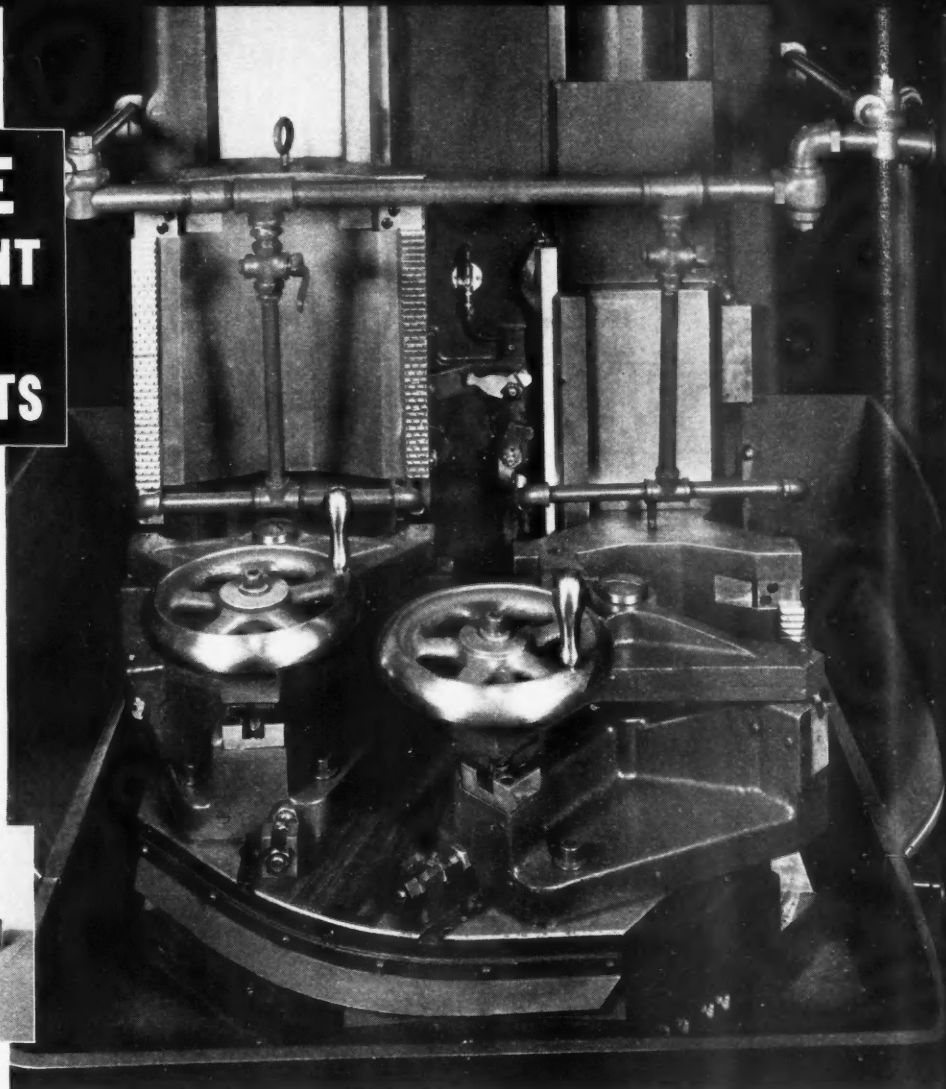
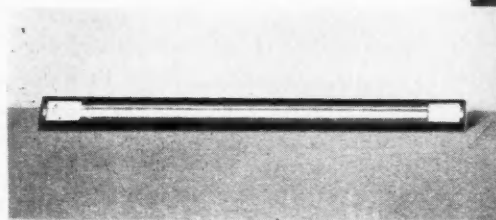
A goodly number of new machine tools have come up over the horizon since the last issue of AUTOMOTIVE INDUSTRIES and are described on the pages beginning with 38. We know of no other way so convenient in keeping abreast with what the machine tool builders are offering, so read this department not only in this issue but in every issue of AUTOMOTIVE INDUSTRIES.

### Plymouth for 1942

41

Things have been happening at the Plymouth plant during recent months and have culminated in the new models they are offering for the new season.

# DISTANCE LEND ENCHANTMENT TO THESE TWO BROACHED PARTS



● CINCINNATI No. 5-42 Vertical Duplex Hydro-Broach Machine. Exclusive swivel table and two alternately cutting broaching tools give you continuous production. See our insert in Sweet's catalog file, or write for catalog M-894.

**E**NCHANTMENT, in this case, is an unusual but highly productive, and accurate method of broaching two widely spaced flats on a long track linkage pin for a tank. The flats are  $1\frac{1}{4}$ " wide,  $\frac{1}{8}$ " deep, and 13" apart. Both of them are broached in one stroke of the ram on a CINCINNATI No. 5-42 Duplex Vertical Hydro-Broach, having two quick-clamping fixtures on the table.

**With this equipment, the production of the pins can proceed at the rate of 580 per hour.**

Contrast this production with that obtained with the obvious and conventional methods, and you can see why it pays to send your surface finishing problems to CINCINNATI. There, you may obtain the advantage of a comparative analysis between *broaching* and *milling*, in determining the most economical method for your parts.

If you would like to see further evidence of the variety of parts which may be economically broached on CINCINNATI'S, we will gladly send you a copy of our brochure "HOW TO STEP UP PRODUCTION WITH CINCINNATI HYDRO-BROACH MACHINES."



**THE CINCINNATI MILLING MACHINE CO.  
CINCINNATI GRINDERS INCORPORATED**

Manufacturers of

Tool Room and Manufacturing Milling Machines

Surface Broaching Machines

Centertype Grinding Machines

Cutter Sharpening Machines

Centerless Grinding Machines

Centerless Lapping Machines.



## OPM-OPACS, Their Functions and Control of Industry

**M**UCH of the discussion about restriction of motor car production becomes quite academic when it is considered that the controlling factor in the situation is the availability of the basic raw materials from which motor cars and their components are made.

The two principal governmental agencies whose functions are closely related to the fortunes of the automotive industry, and in fact to all manufacturing industries, are the Office of Production Management (OPM) and the Office of Price Administration and Civilian Supply (OPACS). While this is not news to the management of automotive concerns, the fact is that the specific functions of these agencies are not clearly defined in the minds of many business men. This is not surprising when you consider that both OPM and OPACS have overlapping functions in some respects while in other respects their sphere of action is not clearly drawn even in official circles.

It may be helpful, nevertheless, to examine those functions of each agency which appear to be clear cut on the surface. Certainly it is clear that OPM controls all defense activity—raw materials, finished goods, machine tool allocations, etc. OPM has taken the initiative as to the classification and control of raw materials. In a release published in the newspapers on Aug. 10, OPM placed steel manufacture under priorities so that from now on steel is no longer available, for any purpose, without clearing through OPM. The same restrictions already apply with respect to certain small cutting tools.

When you examine the functions and actions of OPM it is clear that even without restrictions on motor car production and without a program of equitable allocations as between the producers in the field, a basic and stringent control stems directly from OPM. If the supply of steel, so basic to motor car manufacture, is restricted then you have the first major control of production. Similarly, restrictions placed on other elements such as nickel, tungsten, aluminum, chromium, etc., which are required in only small amounts, can limit the making of motor cars just as effectively as a major allocation program.

It has been the function of OPM to keep track of

the materials required for all manner of defense products and to earmark, day by day, more and more of the available materials for this purpose. This process is too well known to require further repetition. What of the effect on civilian uses? In substance the earmarking of materials by OPM has left only certain kinds of materials for civilian use. But more important than this is the fact that only limited amounts of these materials are left over. According to estimates made by OPACS the amounts left for civilian use are insufficient to carry on all of the manifold activities of our industrial system at the accustomed levels.

Keeping these facts in mind we can appreciate better the functions of OPACS. This agency gets from OPM reports on the materials still available for civilian use; and the estimated amount of each of these materials. That is the starting point. As we understand it, OPACS has been charged with the responsibility for studying consumer minimum needs and for working out some means of getting the available supply of materials spread around to all essential civilian industries. It appears patent that this consideration—and no other—has determined the policy of restricting production in various fields of civilian supply.

OPACS faces a job of gargantuan proportions. It must survey the principal consumer durable goods industries to determine their capacity, their volume of sales, their consumption of materials, their stocks. As a result of such studies it must determine how far the store of available materials can go around.

So far as the automotive industry is concerned it is a foregone conclusion that restrictions will be imposed on the output of the industry, with a definite allocation of volume for each producer. It is quite likely, too, that following the suggestion made by industry leaders, more consideration will be given to the independents who, unquestionably, stand to suffer more than the major producers. The same policy will be extended to parts and accessories manufacturers.

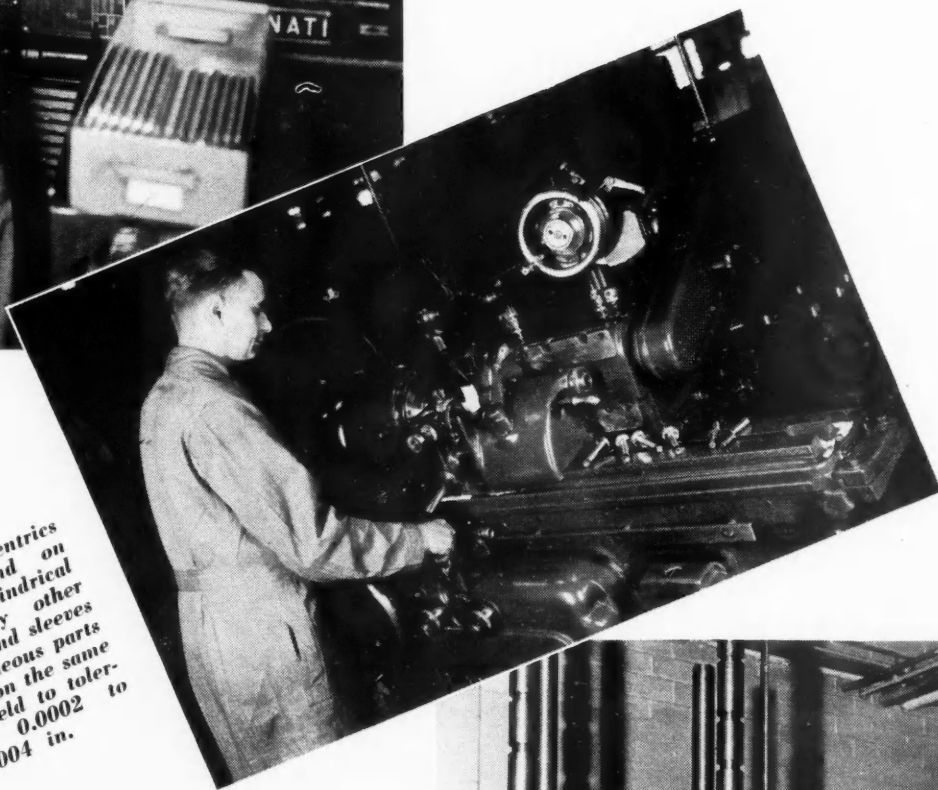
The impact of restrictions on the parts industry poses a complex picture, one which is quite difficult to generalize. For example, most parts makers who produce for original equipment, also make service parts.

*(Turn to page 74, please)*



*The injector plunger is lapped on this Cincinnati Centerless lapping machine, holding a tolerance of plus or minus 0.00003 in. on the entire length.*

*Fuel pump eccentrics are finish-ground on this Landis cylindrical grinder. Many other small shafts and sleeves and miscellaneous parts are ground on the same machine, held to tolerances of 0.0002 to 0.0004 in.*



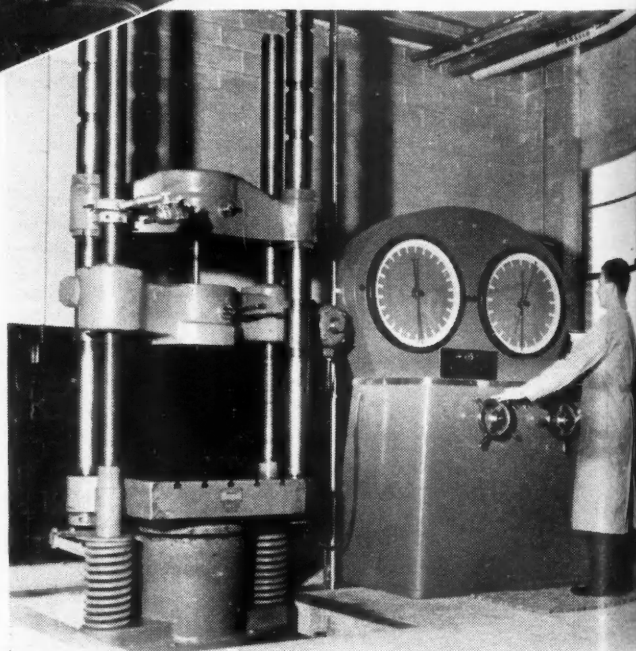
# Million

The past two years have marked an expenditure of something over a million dollars for new building construction and equipment in the interest of increased productivity and higher quality levels. An important place in this program is occupied by the engineering and research

**F**OUR YEARS ago (July 3, 1937, AUTOMOTIVE INDUSTRIES) we recorded the details of the equipment and manufacturing procedures employed in the production of Cummins Diesel engines for automotive applications. Since that time, the constantly increasing demand for the product as well as the requirements of improved quality have resulted in an expansion of production facilities and the introduction of many outstanding items of new equipment.

By JOSEPH GESCHELIN

*Prize exhibit in the metallurgical laboratory is this giant, 200,000-pound Baldwin-Southwark tensile testing machine.*





# Dollar Program

## *advances Production Facilities of Cummins Engine Co.*

laboratory, located apart from the main manufacturing buildings, comprising over 10,000 sq. ft. of floor space.

This provides the most modern technical facilities for testing materials, for engine testing, for engine development, thus safeguarding the future of the company and assuring its customers the benefits of scientific advances in the art of diesel engine development.

Perhaps the biggest change in the plant layout has been effected by the introduction of the new fuel pump

and injector building which provides a floor space of some 16,400 sq. ft. Here are concentrated the new facilities for machining the component parts of the injectors, an inspection department, and assembly departments for injectors and fuel pumps.

The major manufacturing departments have been completely rearranged and expanded, providing 78,340 sq. ft. of productive floor space for the machining of cylinder blocks, cylinder heads, connecting rods, crankcases, and the variety of other engine components built in the Cummins plant. Too, there is an entirely new heat treating department provided with the latest types of furnaces and automatic controls.

Literally scores of machine tools of the most modern types have been installed during the past

*This is the Sixty-third  
in the series of monthly  
production features*

*(Left) One of the two Heald Bore-Matic precision boring machines used in the housing department. The operation being checked here is for size and accuracy of alignment of cross-bores. Limits for concentricity and alignment are 0.001 in. in six inches for alignment—0.0002 in. for concentricity.*



*Typical of the many hand-lapping operations is this view showing the lapping of fuel pump bodies to assure long-lasting, leak-proof joints. Following this operation, the gear pockets and shaft holes are precision bored on the Heald Bore-Matic, locating from the lapped face.*

few years, replacing the older equipment, making possible higher productivity and improved quality at lower cost levels. Among these items of equipment are such well-known machines as the Heald Bore-Matic, American Hole-Wizards, Cincinnati Centerless grinders, lappers, and milling machines, Landis grinders, special Norton lapper, special Ex-Cell-O rifle reaming machine, Warner & Swasey turret lathes, Micromatic Hydrohoner, Gisholt lathes, huge Baldwin-Southwark tensile testing machine, Fay automatics, Natco drills, etc.

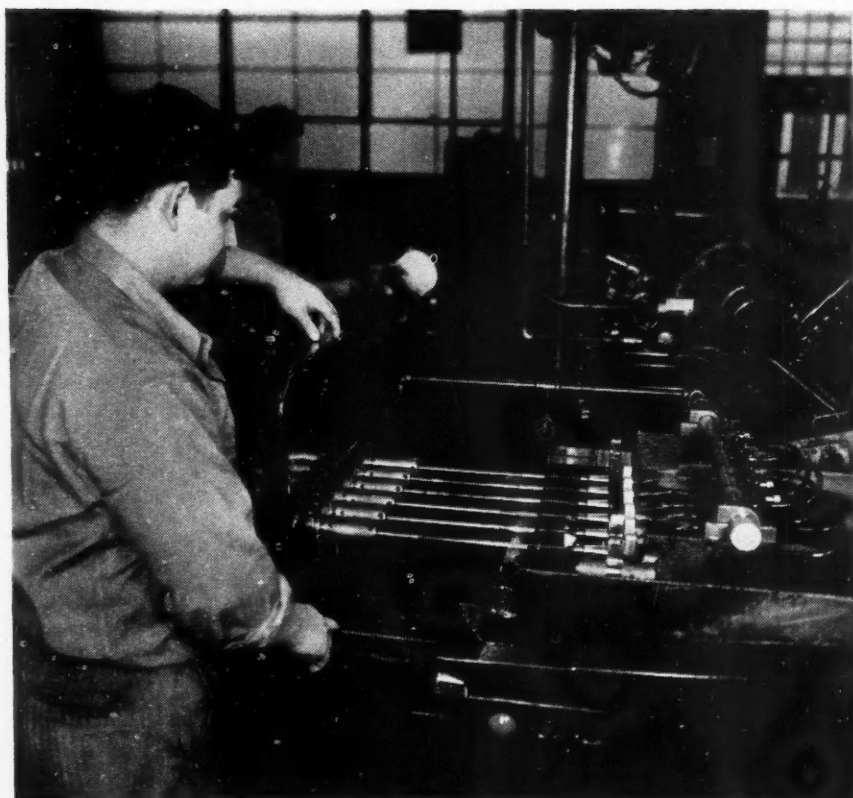
In addition, Cummins has acquired some of the finest quality control devices known to the art. Among these are the J & L Comparator, Pratt & Whitney Electro-limit gages for internal and external checking, Van Keuren optical flats for checking the fuel pump distributor faces, and an Abbott Profilometer.

Generally speaking, the main manufacturing division has been segregated into specialized departments each of which is arranged for machining an entire family of similar parts for all engines. Among these are departments for connecting rods, cylinder blocks, cylinder heads, crankcases, a self-contained department for fuel pump and governor housings and fuel pump distributor parts, rocker lever line for all manner of parts of this character, a grinding department, etc. On the second floor gallery, one side has a small bar screw machine department, while the other side has complete facilities for machining all kinds of small and odd levers, governor weights, etc.

In keeping with the latest developments in the field of lighting, to improve seeing conditions the entire plant has been equipped with fluorescent lamps which

*Pratt & Whitney No. 2A precision jig borer is used to check purchased jigs and to machine jigs and certain production parts.*

*(Below) Close-up of the special Ex-Cell-O six-spindle rifle reaming machine designed for multiple-reaming of the injector body bore.*

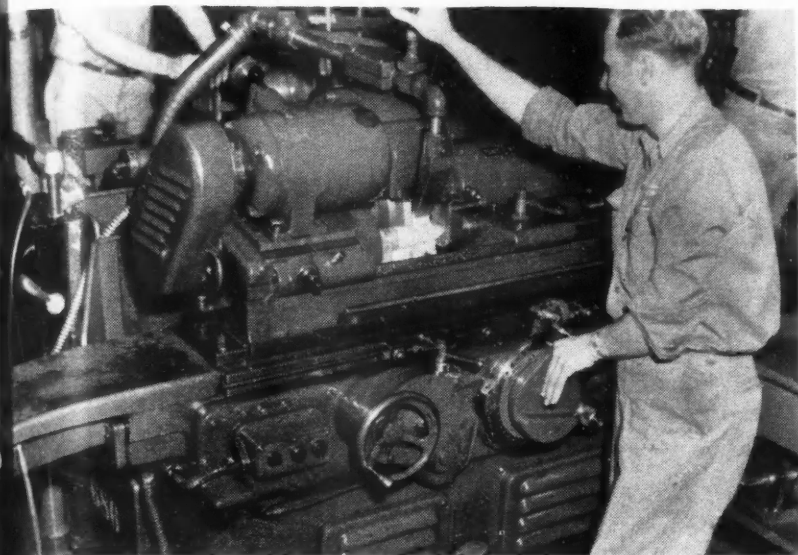


are mounted directly over each machine.

It may be noted that the accuracy of fitting certain types of mating surfaces is facilitated by the hand lapping of such surfaces. This applies specifically to the joint surfaces of the con rods and caps, main bearing caps, pump housings, etc., where joint tightness is of major importance. Our readers will observe that this is precisely the practice in aircraft engine manufacture, as in the case of Allison for example, and is also found in the machining of parts of the Hydra-Matic transmission.

An interesting feature of the machine shop is the "Odd Lots" department which is devoted to the machining of small lots of parts and attachments specified on special orders. It handles such parts as flywheels, manifolds, housings, etc. The department is equipped with boring mills, milling machines, drill





*Double-purpose Cincinnati grinder for finishing the nose end of the injector body. It grinds the straight section with a plunge cut, also finishes the tapered end in another setting. The straight portion is held within 0.0002 in. while the tapered end must be perfect and without run-out.*

presses, etc., and is self-contained for the complete finishing of the parts. Some idea of the reason for a special department for this purpose may be gained

from the fact that Cummins has at least 500 different flywheel drawings of which 300 types are in active production.

Some of the major activities to be covered in this article will be described in the sections that follow.

### Main Machine Shops

A fairly good impression of the activity in the machine shop may be gained from the routings of the connecting rod and fuel pump housing, reproduced elsewhere. An interesting feature of the machining of housings is the employment of the familiar Heald Bore-Matic precision boring machines. There are two

## Factory Routing of Injector Body

### OPERATION AND EQUIPMENT

#### HEAT TREAT

Heat treat

**FACE** top, finish **TURN** 0.997 in.-0.998 in. dia. x 19/32 in. dia. and **COUNTERSINK** 1/16 x 45 deg.

Warner & Swasey turret lathe

Rough **FACE** overall length and center

Etlund 3-spindle drill press

**FACE** underhead, rough **TURN** thread dia. rough turn 1 9/16 in. dia., rough turn 0.6563 in. dia., finish turn taper

Gisholt turret lathe

Semi-finish **TURN** 19/16 in. dia., semi-finish 0.898 in.-0.895 in.

Carroll & Jamison lathe

**DRILL** (2) 9/16 in. holes through

Allen 2-spindle drill press

**COUNTERSINK** (2) holes 11/16 in. underneath side

Allen 2-spindle drill press

**MILL** inlet and drain connecting face and burr

Cincinnati milling machine

**DRILL** plunger hole to 0.363 in. dia.

P & W gun drill

#### WASH

Wash tank

**HEAT TREAT** 750 deg. Fahr. (2) hours and cool in still air

Lindberg furnace heat treat

#### SHOT BLAST

Wheelabrator

**DRILL** (2) holes, **COUNTERSINK** (2), **SPOTFACE** (2)

Etlund drill press

**REAM** plunger hole 0.3718 in.-0.3710 in. and 0.3739 in.-0.3736 in. and **WASH**

Ex-Cell-O 6-spindle reaming machine

**REAM** plunger hole 0.3744 in.-0.3740 in.

Ex-Cell-O 6-spindle reaming machine

Finish **FACE** underhead

Carroll & Jamison lathe

**SEMI-FINISH** 19/16 in. dia.

Carroll & Jamison lathe

Semi-finish **TURN** 0.6560 in. dia., semi-finish turn 30 deg.

angle, finish **TURN** 50 deg. angle

Carroll & Jamison lathe

Plunge **GRIND** 1.561 in.-1.560 in. dia.

Cincinnati grinder

Plunge **GRIND** 0.6560 in. dia. x 30 deg. angle

Cincinnati grinder

**SPOTFACE** 29/64 in. flat for starting

Etlund 4-spindle drill

### OPERATION AND EQUIPMENT

Rough **DRILL** 21/64 in. x 19/32 in. deep

Etlund 4-spindle drill

**Drill** (1) 11/64 in. hole x 4 1/2 in. deep

No. 782 Leland-Gifford drill

Finish **DRILL** 21/64 in. x 1 5/16 in. flat bottom **COUNTERBORE** 33/64 in. x 7/32 in. deep, finish drill 11/64 in. to depth

Etlund 4-spindle drill

**COUNTERBORE**, rough **REAM**, finish **DRILL** and ream

0.1880 in.-0.1870 in. to 2 7/8 in. (+0.004 -0.002)

Etlund 4-spindle drill

**DRILL** (2) 3/16 in. (0.189 in.) x 1 1/2 in. deep. **DRILL** (1)

7/32 in. hole x 9/16 in. deep

**COUNTERSINK** No. 12 holes

Henry & Wright drill press

**DRILL** (1) No. 55 (0.052 in.) x 0.531 in. deep

Avey drill press

**DRILL** (1) No. 55 (0.052 in.) x 50 deg. hole

Avey drill press

**DRILL** (2) 5/32 in. x 20 deg. holes

Henry & Wright drill press

**TAP** (2) 12-24 x 3/8 in. deep

Etlund taper

**TAP** (2) 7/16 in.-20 x 9/16 in. deep

Etlund taper

**TAP** (1) 3/8 in.-24 SAE x 1 in. deep (**WASH** in dip tank)

Etlund taper

**MILL** 3/8 in.-20 thread

Hall planetary mill

Disk **GRIND** inlet and drain connecting face

Delta disk grinder

**GRIND** taper

Cincinnati plain hydraulic grinder

#### PENETRATE

**REAM** plunger hole 0.3744 in.-0.3746 in.-0.3753 in.-0.3750 in.

**WASH** all holes with pressure washer, plug plunger hole

and classify, **STAMP** class number on top of body

Ex-Cell-O 6-spindle reamer

**WASH** on pressure washer

Tank

**TEST** for fuel flow through fuel holes (0.7) gallon by mea-

sure in 1.5 min. @ 200 lb. pressure

AE-2-1 test stand

**CHECK** and redrill after flow test

Avey single spindle drill press

**FACE** gasket seat and **CHECK** clearance angle and re-

move **BURR**—check drilling

Bench

## Factory Routing of Injector Cup

### OPERATION AND EQUIPMENT

**MACHINE** inside, Ream, start 45 deg. plunger seat, **FACE**, rough **TURN**, rough 30 deg. **TAPER** and **CUT OFF**  
Warner & Swasey turret lathe

**WASH**  
Tank

**HEAT TREAT** to remove strain 750 deg. (2) hours and cool in air  
Heat treat

**MILL** threads  $\frac{7}{8}$  in.-20 to 0.8425 in. P.D.  
Hall planetary mill

**MILL** 6 splines and wash  
Cincinnati mill

Finish **FACE** skirt  
Bench

Hand **REAM**, semi-finish gasket face  
Bench

Finish A.O. outside  
Warner & Swasey turret lathe

Semi-**FINISH** plunger seat  
Warner & Swasey turret lathe

### OPERATION AND EQUIPMENT

**DRILL** center hole  
Avey single spindle drill press

**DRILL** 6 spray holes 0.007 in. x 17 deg. (Check each 25th piece for spray angle)  
Muehlmann sensitive drill press (3)

**HONE** tip  
Delta lathe

Hand **REAM**, **FINISH** face gasket face and finish **REAM** plunger seat. (Check each 25th piece for shut-off)  
Bench

**STAMP** letter "J" on 0.998 in. dia. to indicate material  
Bench

**PENETRATE**  
Tank

**WASH**  
Tank

Remove **BURRS** from spray holes, **WASH**, oil and **ASSEMBLE** gasket  
Bench

of these machines in the housing department, a number of housings—the fuel pump housing, the fuel pump body, and the governor housing—being routed over the same machines. One of the Bore-Matics is a three-spindle machine; both are fitted with Carboly tools.

The fuel pump disk and cover involve many fussy operations, easily the most precise being the mating faces. It will be recalled that in the Cummins fuel system these elements control the distribution of fuel to the injectors. They must fit together with the accuracy of optical instruments to prevent leakage of the fuel with its consequent drop in pressure. After machining and grinding, both parts are lapped on a special Norton lapping machine to assure absolute flatness of the mating surfaces. Flatness is held to 10-millionths of an inch, measured with Van Keuren optical flats.

Cummins boasts one of the finest connecting rod job-lot machining lines to be found in the industry. Not only is the line-up designed for precision work but it has the flexibility of equipment and tooling to permit the machining of the gamut of rods and caps required

for the entire line of engines. The routing of the Model H rod is representative of the operations in this department.

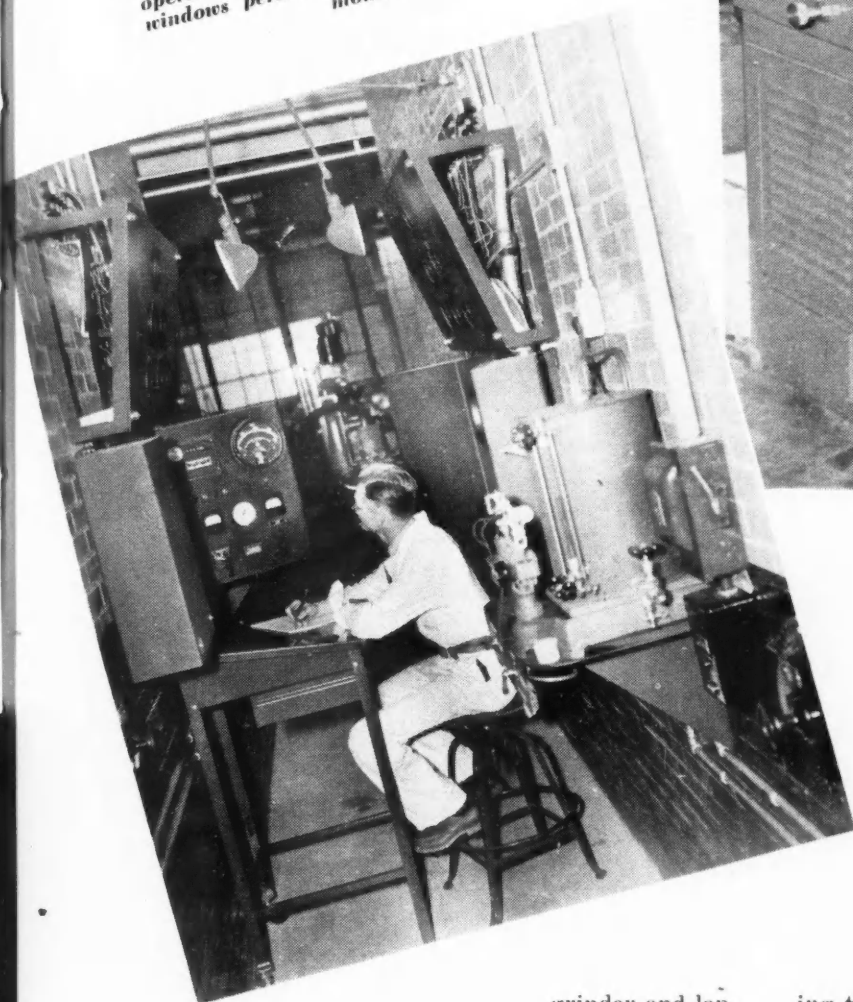
The connecting rod is machined from a high alloy steel forging. Before being placed on the production line, each forging is carefully inspected for defects on a Magnaflux machine. Extremely close manufacturing tolerances are held throughout to assure proper backing for the shell-type bearing used in the rod and to maintain correct center distances. After machining, the joint faces of connecting rods and main bearing caps are ground and hand-lapped on the same face



*Use of specially designed Pratt & Whitney Electrolimit gages in the injector inspection department. Injector body bore is checked by the instrument at the left, injector plunger diameter at the right.*

(Right) Latest addition is this new Micromatic Hydrohoner which will be used for many fine honing operations on component parts.

(Below) Control room for each pair of test cells in the experimental laboratory is operated by a single observer. Safety glass windows permit a full view of each dynamometer.



grinder and lap-  
ping plate as is  
used for the  
bearing cap.

Finishing the joint faces of the rod and cap in this manner prevents distortion of crank hole diameters and results in longer bearing life.

One of the outstanding features of connecting rod design is the step-cut machined in both rod and bearing cap on a Kearney-Trecker mill, providing an interlock, to assure perfect alignment. This feature is also highly desirable from the service standpoint as the step-cut assures reassembly of the rod within limits of 0.0005 in.

The milled bolt grooves in the step-cut rods (Model A only) are formed on the Cincinnati vertical milling machine provided with an auxiliary turntable. Grooves are held parallel within 0.005 in. so as to prevent the

bolt from distorting the rod at assembly.

Preliminary to grinding, the connecting rod is tightened with a torque wrench to preserve hole roundness. Both ends of the rod are bored on a Heald Bore-Matic, the small end being finished within 0.0005 in. while 0.010 in. of stock is left for finish grinding. This operation is performed with cemented-carbide tools to obtain a smoother hole for further grinding operations. Finish grinding of the crank end is done on the latest type Heald precision gap grinder. Size of hole is held within 0.0001 in. and a perfectly smooth finish is obtained. During this operation the rod is checked with a Swedish Gage.

Before the wheel grinds the final 0.0005 in. of stock it is automatically retracted and dressed by a diamond dresser. The fine finish obtained by these precision methods provides an accurate fit for the bearing shell with the assurance that the full bearing area will be utilized. The bronze bushing in the small end of the connecting rod is bored on a Heald Bore-Matic and is held for size within 0.0005 in.

Operators and inspectors maintain a close watch for all defects in materials and workmanship at every step in the manufacture of the connecting rod. The pictorial section shows an inspector checking parallelism, length and twist of the rod on two special checking fixtures. Limits are 0.0001 in. in 12-in. for parallelism and twist; and 0.002 in. for length.





*Fuel pump covers and distributor discs are precision lapped on this new Norton lapping machine, then hand-lapped on the face plate at the left to produce a flat surface compatible with an optical flat. The Van Keuren optical flat measuring equipment may be seen in the background at the left.*

### **Injector Department**

All injectors for Cummins diesel engines are machined and assembled in the new injector and fuel pump building which was placed in operation in 1939. This building is equipped with precision machinery of the latest type, with production lines laid out for straight line operation. The steps in the machining of the principal parts—injector bodies, injector plungers, and injector cups—are outlined on the factory routings.

The injector body is a heat-treated steel forging checked to insure uniform hardness. First machining operation is performed on No. 2-A W & S turret lathes. The part is held in formed jaws while the top is faced and the locating trunnion turned. Only one close limit is held at this operation—that of the diameter of one trunnion which has a tolerance of plus or minus 0.0005 in. The bodies are then rough faced to length and centered for the Gisholt automatic lathe operations where the body is faced under the head, three straight diameters semi-finished, and a taper finish turned.

The plunger hole is rough drilled on Pratt & Whitney gun drilling machines. A drilling

and milling operation follows for the stud holes and inlet and drain connection face, after which the body is treated with Pentrate to prevent rusting.

Another drilling operation is performed on the part before it is taken to a special horizontal multiple spindle reaming machine, built by Ex-Cell-O. This machine handles all sizes, taking six small injectors or three larger ones at a time. Here begins a series of precision reaming operations. Two roughing reamers are run through the plunger hole, the first reaming to a tolerance of plus or minus 0.0004 in.; the second to a tolerance of plus

### **Factory Routing of Injector Plunger**

#### **OPERATION AND EQUIPMENT**

**ROUGH** 45 deg. point and **CUT** to length  
No. 223 Warner & Swasey turret lathe  
**FORM** socket 0.1575 in. radius and rough neck, and break corners, **POLISH** socket  
No. 223 Warner & Swasey turret lathe  
**HARDEN** 64-60 (c) Rockwell  
Heat treat  
Rough **GRIND** 0.381 in. dia. (4 passes)  
Cincinnati centerless grinder  
Rough **GRIND** 45 deg. point to 0.460 in. dia.  
Norton grinder  
**DRAW** at 350 deg. Fahr. and **REDRAW** at 350 deg. Fahr.  
Heat treat  
**GRIND** groove  $\frac{1}{8}$  in. x 0.341 in.-0.340 in.  
Gallmeyer & Livingston grinder  
**CLEAN** and polish socket  
Delta lathe  
Finish **GRIND** 0.3754 in. dia. (3 passes)  
Cincinnati centerless grinder  
**INSPECT** for warp—limit 0.0004 in. extreme  
Bench  
**LAP** grind to size 0.3747 in.-0.3748 in.-0.3749 in.-0.3750 in.  
(4 passes) place in container  
Cincinnati lapping machine  
Finish **GRIND** 45 deg. point  
Brown & Sharpe grinder  
**GRIND** point to length (0.406 in.-0.405 in.)  
Specially built grinder  
**BREAK CORNER** at top end  
Emery stand  
Triple "A" **LAP-POLISH** (2 passes), place in cardboard tubes  
Cincinnati lapping machine  
Final **INSPECTION**. Check diameters as to class and finish  
Bench

## Factory Routing of Fuel Pump Housing

### OPERATION AND EQUIPMENT

**MILL** base  
Cincinnati vertical mill

**DRILL** 6 holes, **REAM** 4 holes  
Natco drill

**MILL** check valve boss  
Cincinnati vertical mill

Straddle **MILL** (2) faces  
Cincinnati duplex mill

Rough **MILL** disk housing top  
Cincinnati horizontal milling machine

**MILL** float chamber pad  
Cincinnati horizontal milling machine

**GRIND** base after milling and file clearance  
Beasley disk grinder

**BORE I.D.**, cut oil groove, **COUNTERBORE**. Bore 2 5/64 in., **CHAMFER** 3/64 in. x 0.950 and finish face dowel pin hole  
Warner & Swasey turret lathe

Rough **BORE I.D.**, face end, bevel 3/64 in. x 45 deg.  
Warner & Swasey turret lathe

**MILL** fuel pump rocker lever clearance  
Cincinnati vertical mill

Finish **MILL** 3.562 in.  
Finish **BORE** 4.750 in. I.D., finish **BORE** 3.750 in. I.D., finish **BORE** 2.440 in. I.D. x 0.575 in. deep  
Heald Borematic

**DRILL** 10 holes  
Natco drill

**DRILL** (4) "U" holes  
Natco drill

**DRILL** (4) holes  
American radial drill press

### OPERATION AND EQUIPMENT

**DRILL** (4) letter "T" x 5/8 in. deep and (3) "U" holes x 13/16 in. deep  
Natco drill

**DRILL, TAP, COUNTERBORE, SPOTFACE** miscellaneous holes  
American radial drill press

**DRILL, REAM, SPOTFACE**  
**COUNTERBORE** (1) hole, counterbore (1) hole, 1 5/32 in. I.D.  
American radial drill press

**TAP** 4 holes, **SPOTFACE** underneath side of 11/16 in. hole 13/16 in. spotface and hollow **MILL** clearance on inside of boss  
American radial drill press

**DRILL** (1) 1/4 in. hole for fuel oil return  
American radial drill press

**TAP** (4) 5/16 in., (4) 3/8 in., (3) 7/16 in. and (2) 1/2 in. holes  
Hammond drill

**SPOTFACE** (2) holes to 1 in. dia.  
2-spindle drill press

**TAP** (4) 7/16 in. USS  
Jackknife

**BURR, FILE and GRIND**  
Bench

**WASH**  
Wash tank

**BORIZE** (2) 1.000 in. holes and (1) 0.8750 in. 0.8745 in. hole and **COUNTERBORE** 1.125 in. x 0.218 in.  
Heald Borematic

**DRILL** (1) 11/64 in. x 5/16 in. deep and ream 3/16 in. x 1/4 in. deep  
Edlund single spindle drill press

**INSPECT**

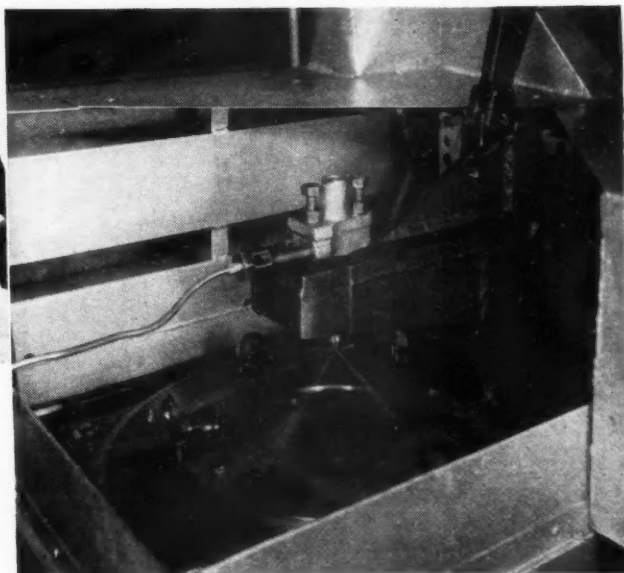
or minus 0.00015 in. A third, semi-finishing reamer, then prepares the hole for further machining operations, the tolerance being plus or minus 0.00002 in.

Two lathe operations prepare the body for the two grinding operations—one a common plunge grind, the other two thin wheels on a special wheel mount which spaces them so that in one operation, a straight diameter and a 30-deg. taper is ground. These operations

*As an example of the painstaking care with which connecting rods are machined is this final inspection for parallelism, length, and twist. Limits are 0.001 in. in 12 in. for parallelism and twist; 0.002 in. on the length.*



*Accuracy of injector cup nozzle drilling is verified by means of this device. Each of the six (0.0055 in. diameter) holes must strike the target of the checking fixture within plus or minus one degree vertically and plus or minus two degrees circumferentially.*



## Factory Routing of "H" Connecting Rod

### OPERATION AND EQUIPMENT

**MAGNAFLUX** and **STAMP** date  
 Straddle **MILL** crank end  
 Straddle **MILL** pin end  
 Rough **BORE** pin end and rough bore crank end  
   Moline Hole Hog  
**BORE** pin end  
   Heald Borematic  
**MILL** locating pads  
   No. 6 Pratt & Whitney mill  
**SPLIT** and **MILL** bolt and nut pads  
   Cincinnati milling machine  
**MILL** end face  
   Kearney-Trecker horizontal mill  
**GRIND** end face on rod  
   Abrasive grinder  
**GRIND** end face on cap  
   Abrasive grinder  
**DRILL** (2) 37/64 in. holes in rod  
   Cincinnati-Bickford drill press 2 spindle  
**DRILL** (2) 37/64 in. hole in cap  
   Cincinnati-Bickford drill press 2 spindle  
 Semi-finish **BORE** crank end—rods and cap  
   Bemont boring mill  
**BURR** rod  
   Bench  
**BURR** cap  
   Bench

### OPERATION AND EQUIPMENT

**DRILL** long oil hole through and **CHAMFER** oil hole  
   Leland-Gifford drill press  
**CUT** oil groove  
   Cincinnati drill press  
**CHAMFER** pin end of rod  
   Barnes drill press  
**MILL** lock slot, connecting rod and cap  
   Kent Owens milling machine  
**LAP** connecting rod  
   Lapping plate  
**LAP** connecting rod—cap  
   Lapping plate  
 Line **REAM** bolt holes  
   Cincinnati drill press  
**MILL** bolt head clearance  
   Sundstrand mill  
**ASSEMBLE** for Borematic, using old bolts and nuts and  
   wash old nuts and bolts  
   Bench  
**TIGHTEN** for Borematic  
   Bench  
**BORE** crank end and pin end  
   Heald Borematic  
**CHAMFER** crank end, rod and cap  
   Barnes drill press  
**GRIND** crank end  
   Heald grinder  
**INSPECT**

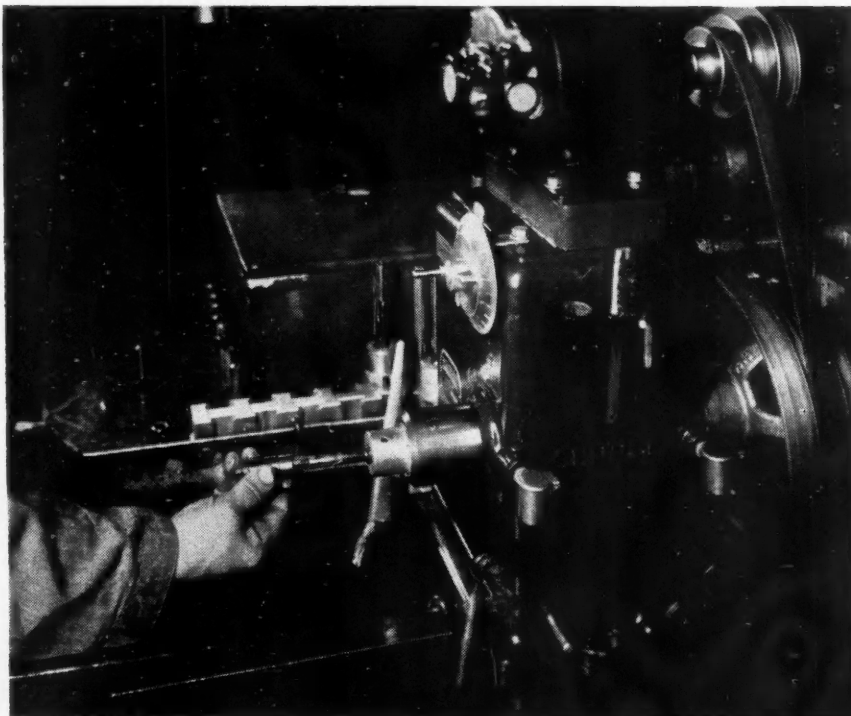
are done on a Cincinnati plain hydraulic grinder with a special wheel dressing cam that holds the wheels in an exact relation to each other. The straight diameter is held to less than plus or minus 0.0001 in. tolerance on the diameter and less than 0.00005 in. eccentricity with the plunger hole. A specially designed

mandrel was developed by Cummins to make these tolerances possible.

The drilling of the check valve hole is done on a three-spindle Leland-Gifford hydraulic step drilling machine with a pump type fixture.

The threads on the injector body are milled on a Hall Planetary thread miller, using special fixtures. One hundred per cent inspection of this operation holds the threads to very close limits as to thread form and diameter. Pitch diameter must be concentric with the plunger hole to a tolerance of plus or minus 0.0001 in. A J & L Comparator is employed in these inspections, using a magnification of 62.5 to 1.

The finishing of the plunger hole is the last mechanical operation in the manufacture of the injector body. This is done with two finishing reamers on the Ex-Cell-O machine after all other work has been completed.



*One of the now familiar Sunnen utility honing machines is found in the machine shop, used for honing and lapping miscellaneous parts.*



(Below) York Ice Machinery Co. refrigerated cold room is used for studies of engine starting under sub-zero temperature conditions. An engine is held in the chamber for several days at 0 deg. Fahr., before tests are started. The operator at the right reports to the recorder outside by means of what is said to be shortest telephone line in Indiana.



There is no attempt to obtain a single diameter but the bodies are classified as 0-1-2-3, these numbers indicating a difference of 0.0001 in. in diameter. The plungers are correspondingly numbered so that a practical interchangeability is obtained without excessive costs.

Painstaking care is taken to produce a highly finished surface in a hole as straight as it is possible to make. This eliminates the slow hand method of lapping plungers and bodies and eliminates all danger of lapping compounds remaining in the metal to carry on a cutting action while the injector is in operation. Further evidence of the care taken is demonstrated by the fact that at the final reaming, dummy cups are screwed on the bodies to duplicate any strains or distortions of assembly.

Special Electrolimit gages were developed by Pratt & Whitney for checking the holes and measurements as close as 0.0000125 in. may be taken.

Injector plungers are received as ground bar stock, are rough machined, hardened, rough ground, normalized and then finish ground. After they have been rough lapped, they are given what is termed an AAA lap finish. Inspections are made at every operation. Grinding and lapping are performed on Cincinnati Centerless machines while the point is ground on a



(Above) Parts hardened in the CECO Hydrizer are held in a neutral or slightly reducing atmosphere, then quenched in oil or water.

B & S Universal grinder.

The quality of the finished plunger is indicated by the limits used. The point of the plunger is checked on the J & L Comparator, both for accuracy of taper

and concentricity of taper with the plunger body. No tolerance is allowed, the points mentioned being dead accurate and as closely as can be checked with the Comparator. Diameters are held to a tolerance of plus or minus 0.000030 in. throughout the entire length. These are checked while being run and again by an inspector before going to assembly.

Surface finish is checked by a Profilometer, being held within 1 to 2 microinches. To protect this high finish, the plungers are placed in individual oiled cardboard tubes.

Injector cups are made from bar stock of heat treated, selected materials which must be entirely free of porosity, seams or segregations. The threads are milled on the same Hall Planetary that threads the body. The inside is finished from the pitch diameter of the thread so that there may be no twisting strain set up in assembly to distort cup or body.

The six minute spray holes in the injector cup are drilled on special indexing fixtures to accurately space the sprays. Diameter of these spray holes ranges from 0.0055 to 0.010 in. according to the engine model and is held to less than 0.0005 in. variation. The angle of sprays is checked on a target fixture on which the cup is placed and fuel oil forced through at a fixed pressure. The sprays must strike the target within plus or minus 1 deg., vertically, or plus or minus 2 deg.,

(Turn to page 76, please)

# Speed Regulators

By B. S. WEAVER\*

**I**N CERTAIN tests with electric dynamometers it is desirable to keep the speed constant. This applies, for instance, in fuel research and in fan tests where the pressure-volume relations of the fan delivery are to be determined. It may be desired to make such determinations for a wide speed range, but in any particular run the speed should be held constant. A vacuum-tube type of regulator developed for this purpose will maintain the speed within  $\frac{1}{2}$  to 1 per cent throughout the power-absorption and motoring ranges of the dynamometer. When normal operation is required, the regulator may be used to keep the field current constant regardless of variations in either

\* Industrial Engineering Dept., General Electric Co.

the supply voltage or in the field-circuit constants.

This type of regulator can be used with both direct-current and inductor-type dynamometers, with combinations of the two, and with combinations of direct-current and hydraulic units. The apparatus, moreover, incorporates a current-limiting feature and permits deviations from the speed or field current for which it is set when there is a tendency for the armature current to become excessive.

The regulator includes a thyatron-type exciter for supplying the dynamometer field, vacuum-tube amplifiers, a speed-regulating generator with voltage proportional to speed, a constant-voltage reference standard, and the necessary transformers, stabilizers and other auxiliaries for dynamometer operation.

The highly desirable features of a vacuum-tube regulator—i.e., no inertia or moving parts, and a high amplification factor—combine to produce high sensitivity with close regulation, simplicity of operation, and freedom from excessive maintenance.

When the regulator is used for speed regulation, a differential voltage between a constant reference voltage and the speed voltage of the regulating generator changes the grid bias on a vacuum-tube amplifier, the plate circuit of the amplifier being connected into the grid bias of the thyatron-tube exciter. Only a very small change in grid bias of the amplifier is necessary to obtain the full range of the field current on the dynamometer. On over-speed, the regulator acts to strengthen the dynamometer field. This increases the load on the dynamometer, whether it is "pumping back" into the power line or sending current through resistors. On under-speed, the field is weakened, to allow the dynamometer to speed up.

To maintain a constant field current when the dynamometer is manually controlled, a differential voltage between the constant-voltage reference source and a voltage drop across a resistor in the field circuit changes the bias of a second amplifier, which is connected in parallel with the amplifier used for speed regulation.

The changeover from speed to current regulation requires a special tube (diode) having two plates and a single cathode. Both the speed and current amplifiers are connected into the thyatron grid circuit through separate plates of the diode tube. The characteristics of the

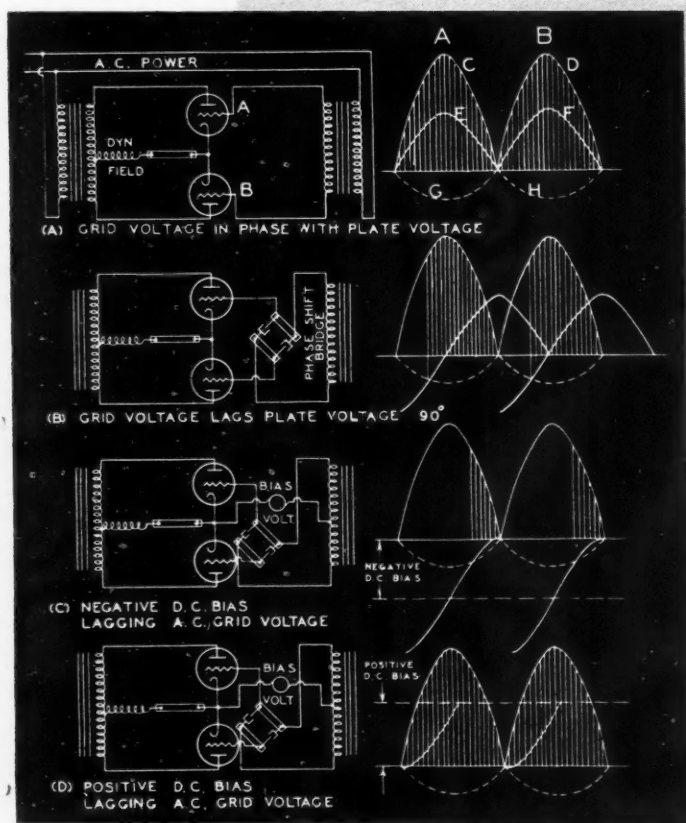


Fig. 1—Showing how a thyatron tube can be made to control the field current of a dynamometer.

# for Dynamometers

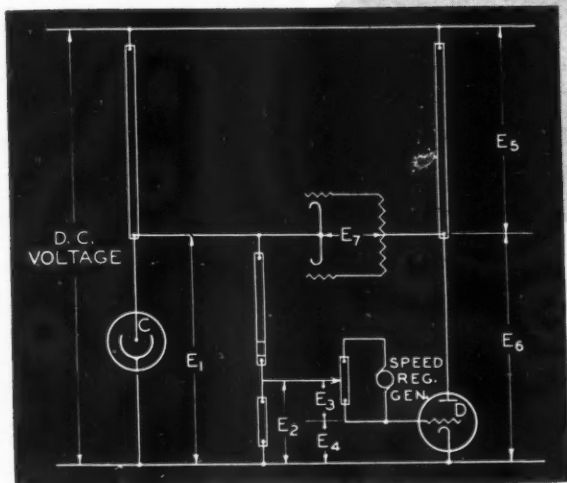


Fig. 2 — Diagram of speed-regulating section.

whichever plate has the higher potential with respect to the cathode. When operating to regulate speed, the manual or current-regulating adjusting rheostat is turned to minimum field; therefore, the diode plate connected to the speed-regulating circuit is at a higher potential, and the speed regulator has complete control of the thyatron grid circuit. By turning the current-control rheostat in the direction of increased field current, a point is reached where the potentials of both plates of the diode tube are equal. Further movement of the manual control to strengthen the field shifts control from the speed- to the current-regulator. This is easily detected by the decrease in speed with increased dynamometer field strength. To complete the change-over to current regulation, it is only necessary to turn the speed-regulating rheostat to the point representing maximum speed. This makes the full range of current regulation available.

To return to speed regulation, the speed regulating rheostat is adjusted in the direction of reduced speed until further adjustment shows actual decrease in speed. At this point the speed regulator has taken control. Full range of the speed regulator is obtained by turning the manual current-regulating control rheostat at its minimum field setting.

The principles of speed control by means of electron tubes are illustrated by the diagrams.

## Thyratron-Tube Characteristics

With the Thyratron tube used to control the field excitation of a dynamometer and connected as shown in Fig. 1 (a), the method of control by changing the grid bias is as follows: The dynamometer field is connected to the common junction of the cathodes of the two thyratrons A and B and to the mid-point of the transformer secondary supplying power to the plates of the two tubes. The voltages applied to the plates of the two tubes are represented by the curves C and D, which are 180 deg. out of phase. Curves E and F represent similar voltages applied to the grids of the tubes, the grid voltage in each tube being in phase with its plate voltage. Curves G and H represent the critical grid voltage necessary to cause the tubes to start firing. When the grid voltage is above line G and the plate voltage is positive, the tube starts firing and continues to carry current until the plate voltage returns to zero. This condition obtains when the grid voltage is in phase with the plate voltage. Each tube fires and carries current throughout the half cycle, as indicated by shading of the entire area under the plate-voltage curves. This represents the maximum possible current flow with the dynamometer field connected between the cathode and the mid-point of the transformer.

One method of adjusting the field current by changing the grid bias is to add a phase-shifting bridge and

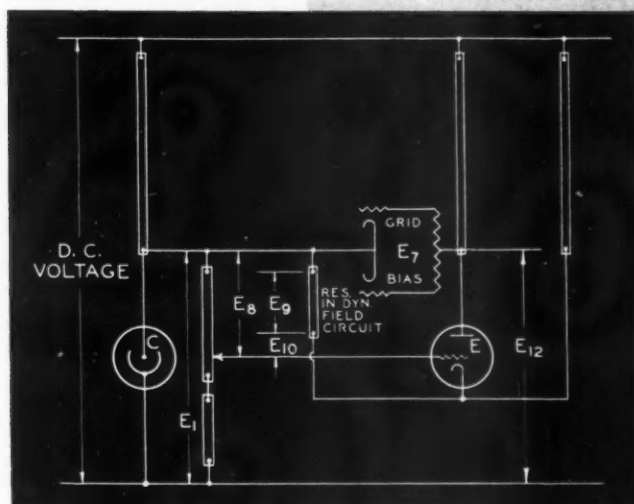
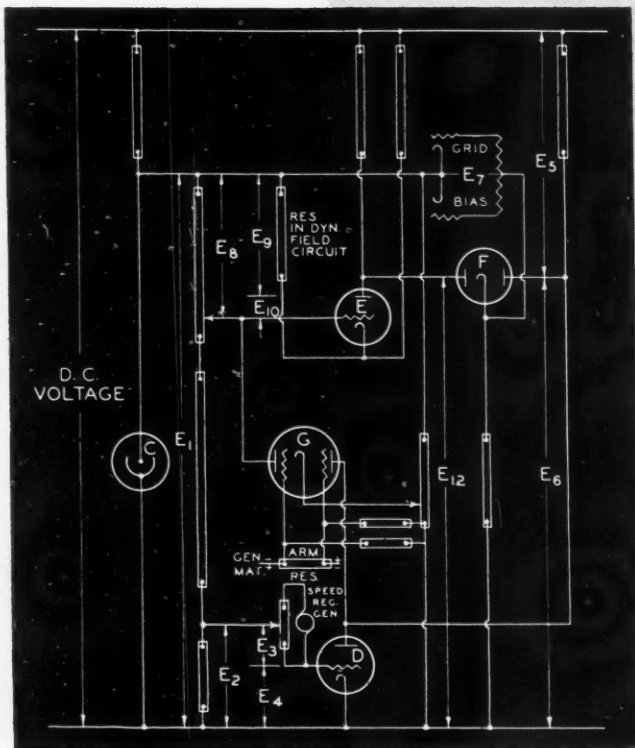


Fig. 3—Diagram of current-regulating section.





**Fig. 4—Diagram of combined speed- and current-regulating sections and current-limiting feature.**

a controllable d-c voltage to the grid circuit of the tubes, as shown in Figs. 1(b), 1(c), and 1(d). In Fig. 1(b), the phase-shifting bridge displaces the grid-voltage wave approximately 90 deg., causing the tube to fire somewhat later in the half-cycle, with a resulting lower current in the field circuit. Fig. 1(c) indicates a negative d-c voltage on the grid circuit, which offsets the a-c grid-voltage wave by the amount of the d-c voltage without changing the phase relationship of the grid voltage to the plate voltage. The grid-voltage curve crosses the critical firing line toward the end of the cycle, and, consequently, only a small current passes through the field circuit. Similarly, as shown in Fig. 1(d), if a positive d-c voltage is applied, the grid-bias voltage curve crosses the critical firing voltage line early in the half-cycle, and the current in the dynamometer field is at the maximum. From the foregoing it may be seen that the entire range of field current can be controlled by a d-c voltage in the grid circuits of the two thyratrons.

#### Reference Voltage

The reference voltage consists of a glow tube in series with a resistor connected to a d-c source of approximately 250 volts. The d-c voltage is obtained from rectified a-c power. The voltage drop across the glow tube remains constant under conditions of varying current or applied voltage. This tube and the

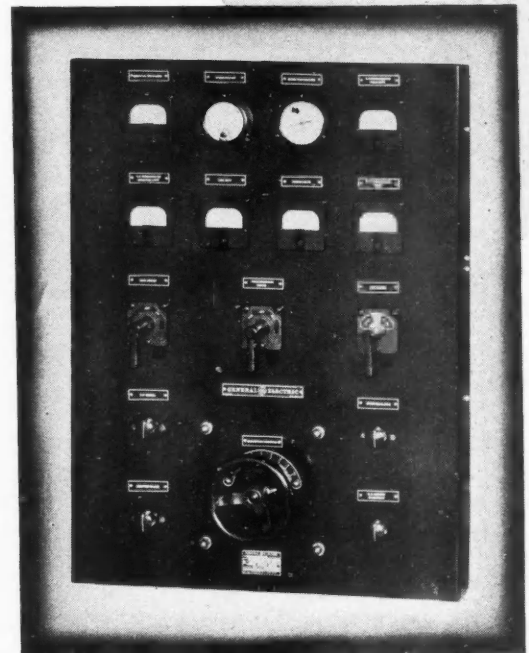
method of connecting it into the circuit are shown in Fig. 2.

#### Speed-Regulating Generator

The direct current generator with Alnico-magnet field develops upwards of 150 volts at maximum speed. It has a practically linear speed-voltage characteristic, and the rotor is designed to hold slot ripple to a very low value. The capacity of the generator is sufficient to permit the use of auxiliary instruments, such as indicating and recording voltmeters.

#### Speed Regulation

A tapped resistor shunted across the glow tube gives a constant voltage  $E_1$  (see Fig. 2). In setting the value of  $E_2$ , the voltage range of the speed-regulating generator, the range of speed regulation provided, and the amount of grid-bias required on the amplifier tube are taken into account. The adjustment of the rheostat shunted across the speed-regulating-generator armature determines the speed at which the generator must be driven in order



**Fig. 5—Master control panel for remote operation of inductor-type dynamometer (300 hp. d.c. and 600 hp. a.c.)**

The instruments and controls mounted on the panel are as follows: Top row, left to right—induction-field amperes, speed voltage, water temperature, d.c. dynamometer field amperes; second row—d.c. dynamometer armature amperes, line amperes, switch volts, d.c. dynamometer volts; third row—load switch, field reversing switch, line switch; fourth row—d.c. manual, speed regulator; fifth row—inductor manual, d.c. current adjustment; large hand wheel between fourth and fifth rows—absorption resistor control.

to make the differential voltage ( $E_s - E_g$ ) equal the critical grid voltage ( $E_c$ ) of the tube. A change of approximately 0.1 volt in  $E_g$  is sufficient to change the plate current in the tube from zero to maximum. The ratio  $E_g/E_s$  is a measure of the percentage of regulation of the equipment.

When the plate current of the tube is zero, the voltage  $E_s$  is maximum and is greater than  $E_g$ ; consequently, the grid bias  $E_g$  is positive. With increasing plate current in  $D$ , voltage  $E_s$  decreases until at maximum plate current  $E_s$  is less than  $E_g$ . This increase in plate current in  $D$  and decrease in voltage  $E_s$  causes the grid bias  $E_g$  to decrease from a positive, through zero, to a negative value. The change in grid bias  $E_g$  from positive to negative causes the output current from the thyatron tubes  $A$  and  $B$  to the field of the dynamometer to change from maximum to zero.

Without tracing the sequence of operations, it is evident that an increase in speed strengthens the dynamometer field, thereby increasing the load, and that a decrease in speed weakens the field, which results in a decrease in load. This change in load is sufficient to hold the speed within narrow limits.

### Current Regulation

An elementary diagram of the section for current control is shown in Fig. 3. The complete field circuit is not shown there. The voltage drop  $E_r$  across a series resistance in the field circuit is proportional to the field current. The cathode potential varies with  $E_r$ . The adjustable voltage drop  $E_s$  establishes the grid potential of the tube  $E$ . As explained in connection with the subject of speed regulation, the differential voltage ( $E_{10} = E_s - E_g$ ) is a measure of the grid-bias voltage  $E_g$ . Excessive field current increases  $E_{10}$ , reducing the negative grid bias  $E_{10}$  and decreasing  $E_{10}$ , thus forcing  $E_g$  toward negative bias and decreasing the field current. Insufficient field current produces the opposite effect.

### Transfer

Figs. 2 and 3 illustrate the independent action of the speed and current-regulating means without showing the interconnection between the two circuits. Fig. 4 illustrates the method of connecting the plate circuits of the speed- and current-amplifier tubes  $D$  and  $E$  through the dual-plate tube  $F$ , which passes current only through the plate with the higher potential. This tube characteristic provides a means of obtaining a smooth transfer from speed-to-current to current-to-speed regulation without opening any of the circuits.

When operating to regulate speed, the rheostat controlling current regulation is turned to the position of minimum current; consequently,  $E_s$  is greater than  $E_{10}$ , and the amplifier tube  $D$  has complete control of the grid bias  $E_g$ . When regulating current, the speed-control rheostat is turned to the maximum-speed position, hence  $E_{10}$  is greater than  $E_s$ , and tube  $E$  has control of  $E_g$ .

To effect the transfer from speed to current regulation, it is only necessary to turn the current-regulating rheostat in the direction of "full field" until potential  $E_{10}$  approaches  $E_s$  in value. At this point

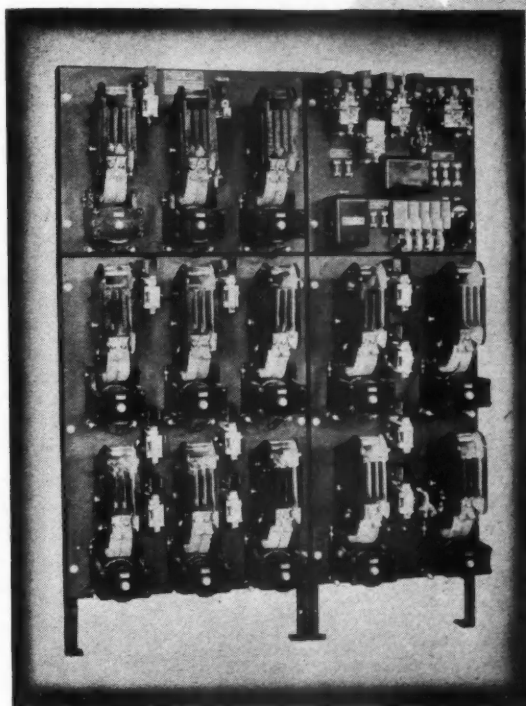


Fig. 6—Remote-operated dynamometer contactor panel for use with master panel shown in Fig. 5.

the current regulator gives the same field strength as that required by the speed regulator to maintain speed. Further movement of the current-regulating rheostat in the same direction increases  $E_{10}$  and causes current to flow through tube  $F$  from tube  $E$  only. This transfer is easily detected from the increased load and field current, as shown on the scale beam and the field ammeter. With the current regulator in operation, the speed-control rheostat is turned to maximum-speed position. This lowers potential  $E_s$  and gives full range to the current regulator.

To transfer from current to speed regulation, turn the speed-regulator rheostat in the "reduced speed" direction in order to raise potential  $E_s$  above  $E_{10}$ . Range is provided by reducing  $E_{10}$  to a somewhat lower value.

This description of rheostat operation suggests a method of establishing a minimum current or maximum speed limit under operating conditions where the unused control rheostat is set at a predetermined point only slightly beyond that necessary to give complete range of the active portion of the rheostat.

### Armature Current Limit

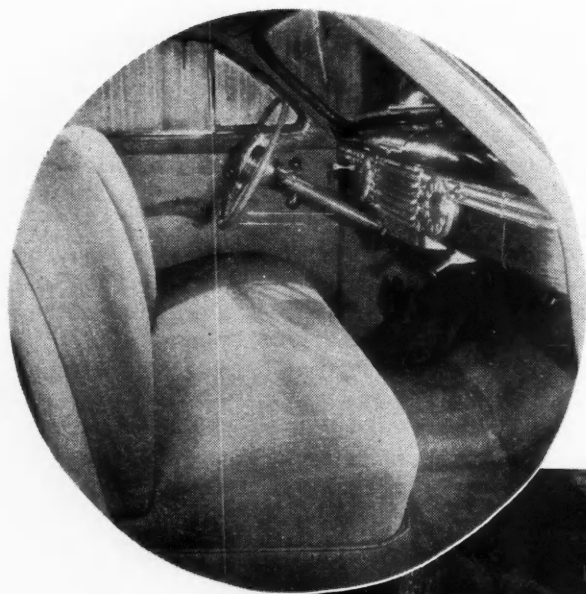
The current-limiting feature, as built into the later designs of regulators (see Fig. 4) slows down regulator action during the period of disturbance in the system, and in many cases prevents a shutdown of

(Turn to page 80, please)

# 1942 Packards

**S**TEMMING from the development of the Packard Clipper, announced in *AUTOMOTIVE INDUSTRIES*, April 15, 1941, the dominant theme of the Packard line for 1942 will be the Clipper styling on certain models of the Six, the Eight, the 160, and the 180 Super Eight. In the process of recasting the new models, certain other body styles will be continued without change, the station wagon being discontinued.

Basic models of the Six and Eight will have Clipper-style bodies mounted on the same 120-in. wheelbase chassis and will be designated as the Special and Custom Series, respectively. The only difference mechanically between these series cars is the engine, the mounting being so arranged that either a six- or an eight-cylinder engine can be installed without affecting any of the running gear components. Last year the Six was on a 122-in. chassis while the Eight had a 127-in. wheelbase chassis. The Clipper styled bodies available for this purpose are a six-passenger four-door sedan, a six-passenger two-door sedan-coups, and a three-passenger business coupe.



*Clipper - styled  
Special Six and  
Custom Eight  
sedan coupe*

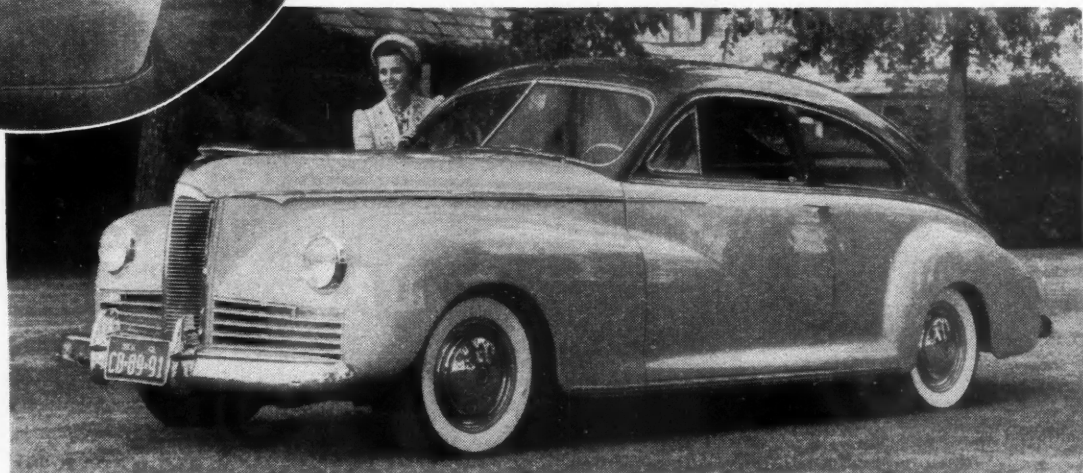
Basic models on the 160 and 180 Super Eight line will be a 127-in. Clipper chassis with a six-passenger four-door sedan, and a six-passenger two-door sedan. The body shells are substantially the same as the corresponding bodies on the Six and Eight.

Convertible coupe models on the Six, the Eight, and the 160 Super Eight will continue unchanged on last year's chassis, with wheelbases—122-in. on the Six, and 127-in. on the Eight and Super Eight. The only significant change is the adoption of side grilles with horizontal bars (instead of vertical bars as last year) so as to follow the general pattern of the Clipper front end treatment on companion models.

The Super Eight Series on the 138-in. and 148-in. wheelbases will continue unchanged the six-passenger sedan on the 138-in. chassis, and the seven-passenger sedan and limousine on the 148-in. chassis, while the 180 Super Eight will continue the 5-passenger formal sedan on the 138 in. chassis.

As to mechanical details, it can be said in general that the Clipper models will have the same character of mechanical design as was incorporated in the 127-in. Clipper chassis announced this spring. Engines remain unchanged except that the output of the Six and Eight has been stepped up by 5 hp., compression ratio being 6.85 to 1 on all engines—the Six, Eight, and Super. At the start of production all engines will have aluminum pistons and this will be carried through on the Eight and Super engines for the entire model season. On the large production Six and Eight engines, however, new tooling for cast iron pistons has been made ready so that Packard can swing into production on cast iron pistons if and when aluminum for this purpose is no longer available. To take care of the

*(Turn to page 82, please)*





# Hudson for '42

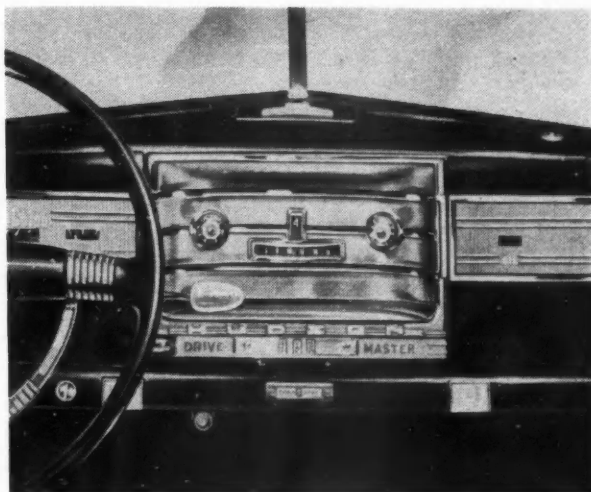
**A** NEW development in driving ease known as the Drive-Master highlights the three new lines of Hudson cars for 1942. Featured also on all models are more flowing body lines and new safety running boards. There are new front-end and fender styling, mechanical refinements to improve operating economy and riding comfort, and new upholstery fabrics.

In the lowest price field, Hudson offers a Six deluxe model, mounted on a 116-in. wheelbase and powered with a 6-cylinder, 92-hp. engine, and a still lower priced model, the Hudson Six, which has the same power and wheelbase. Priced just above is the Super-Six on a 121-in. wheelbase and powered with a 102-hp. engine. In the moderate price field, the new Commodore series rounds out the 1942 line and is distinguished by a more massive front-end design, frontal hood treatment, added decorative moldings, and interior style and comfort features. In this group are the 128 hp. Commodore Eight, mounted on 121 in. wheelbase and its companion car, the Commodore Six, of 102 hp., which is identical in practically every respect except power-plant. Two custom models are also offered in the Commodore series, a Custom Eight coupe on 121 in. wheelbase and a Custom Eight sedan, the largest car Hudson builds, on a 128-in. wheelbase.

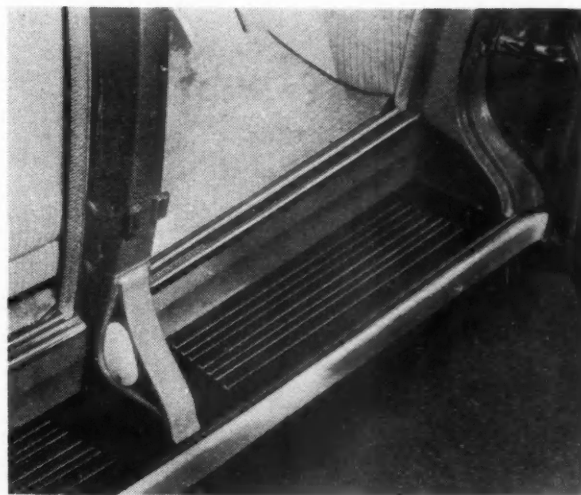
A wide range of body types is available throughout the entire line. Station wagons are included in the Super-Six series. An innovation is the introduction of a convertible sedan in the Hudson Six line.

All 1942 Hudsons are lower and longer. New body lowness is achieved by a redesign of rear frame, which permits rear springs to be lowered. Overall length is increased by more massive bumper and bumper guard treatment.

*(Turn to page 66, please)*



*Hudson instrument panels have a new modernistic design. The Drive-Master panel at the center has a three-button switch for shifting gears either automatically, semi-automatically, or manually.*



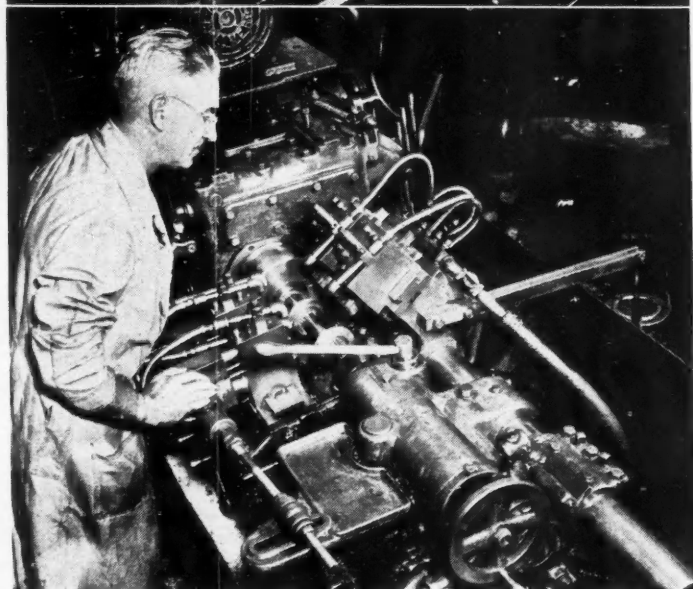
*These concealed running boards are a safety feature on all Hudson cars.*



*Wider horizontal treatment of front-end design appears on '42 Hudsons as pictured here in the Commodore series..*



*Looking down the assembly line for heavy duty rear axles. Timken has four of these lines in operation at the present time.*



## High Speed on Defense

**E**XTOLLED by the personnel of the Detroit Ordnance office as an outstanding example of industrial cooperation in the national defense effort, The Timken-Detroit Axle Co. plant is a veritable beehive of activity. All-out on defense, Timken is producing an endless flow of finished assemblies and component parts for QMC and Ordnance departments of the War Department—front and rear driving axles for four-wheel drive military vehicles, for half-trac vehicles, single-axle and tandem axle bogies, hubs, brake drums, and other components, high speed adapter parts for artillery carriages, fifth wheel assemblies, tank transmissions parts, etc.

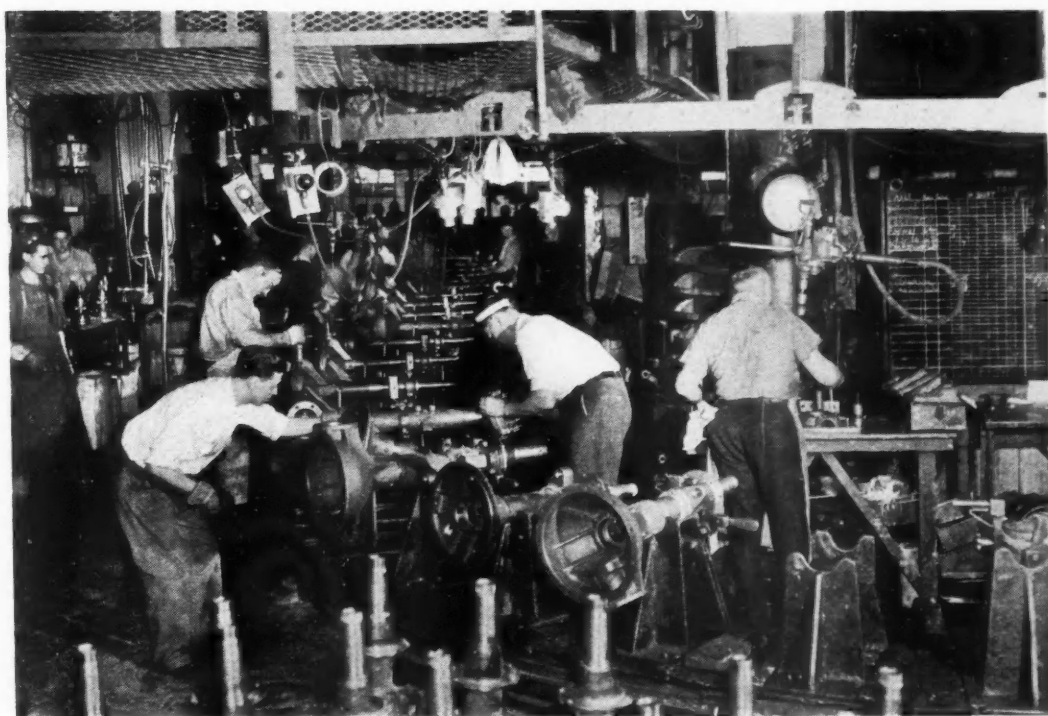
In addition, the Wisconsin Division of the company is producing, among other things, complete tank transmission drive units.

These parts and assemblies are supplied for

*(Center) Here is an old engine lathe rigged up with special cam blocks for turning the spindle end of the high speed adaptor beam. This procedure of converting old equipment made it possible to get the defense work going without waiting for the many items of new machinery now on hand.*

*(Bottom) Differential side gear blanks are formed, two at a time, on this Fay automatic lathe fitted with cemented-carbide tools.*

*Huge merry-go-round assembly conveyor line is used for the high speed assembly of split type axles.*



## Production at Timken

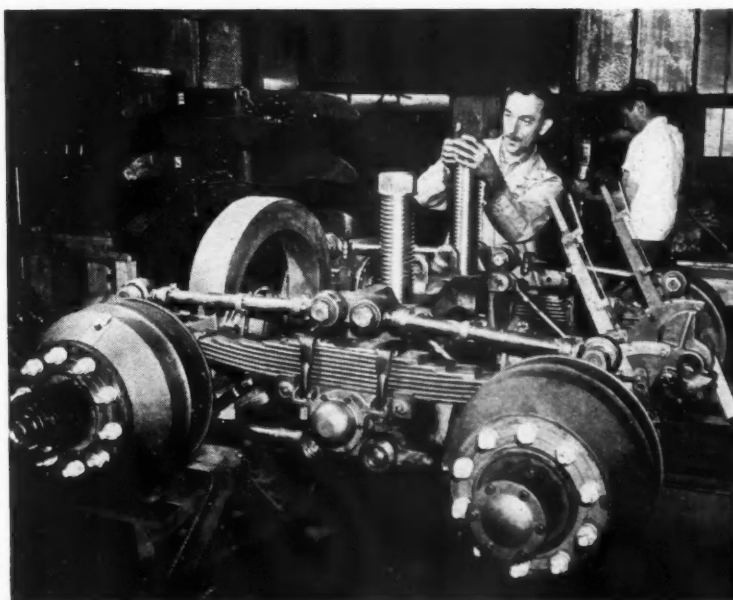
use in QMC military motorized vehicles such as—scout cars, half-trac vehicles; and for Ordnance equipment such as—tanks, howitzers, anti-aircraft gun carriages, limbers, etc. All of this activity is so intimately related to Timken's regular production that both military and commercial units are being produced without interruption.

Some conception of the magnitude of the job may be gained from the fact that the Ordnance Department alone takes more than 4700 component parts. In the process, Timken draws upon the resources of some 500 different suppliers and sub-contractors, marking the operation as a shining example of the principle of spreading the responsibility over a large group of capable contractors.

So intense is the production effort, so broad the scope of manufacturing operations, that the Ordnance Department is using the plant as a training school for Army inspectors. Green men are being constantly brought into the plant for a period of intensive instruction, followed by actual inspection experience on the lines. Eventually these men are transferred to other de-

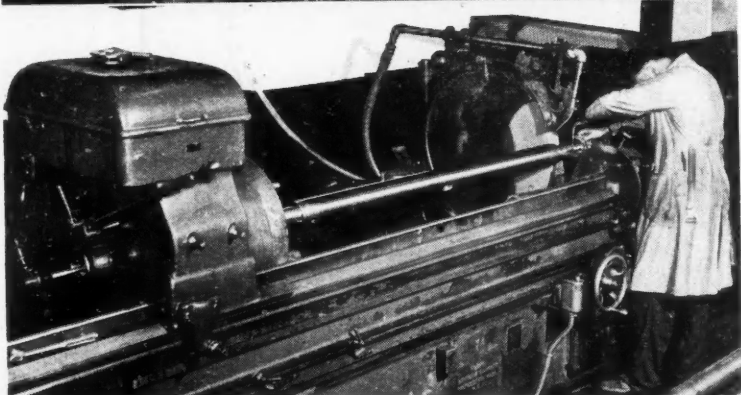
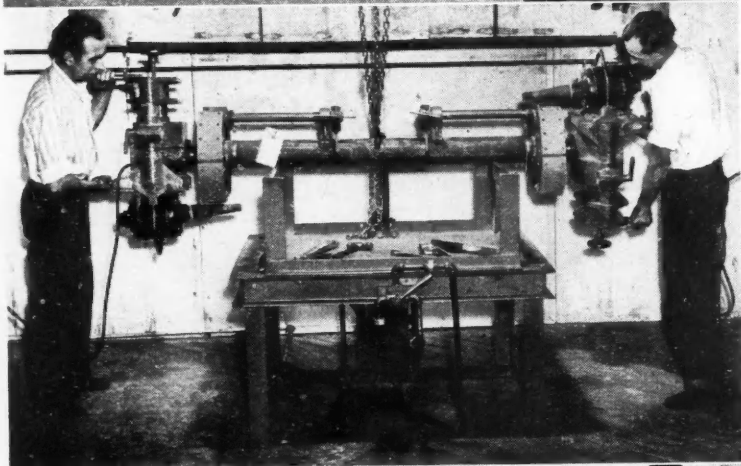
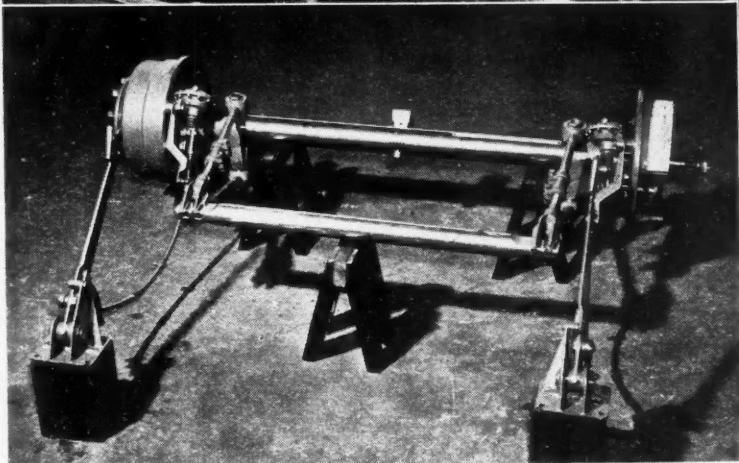
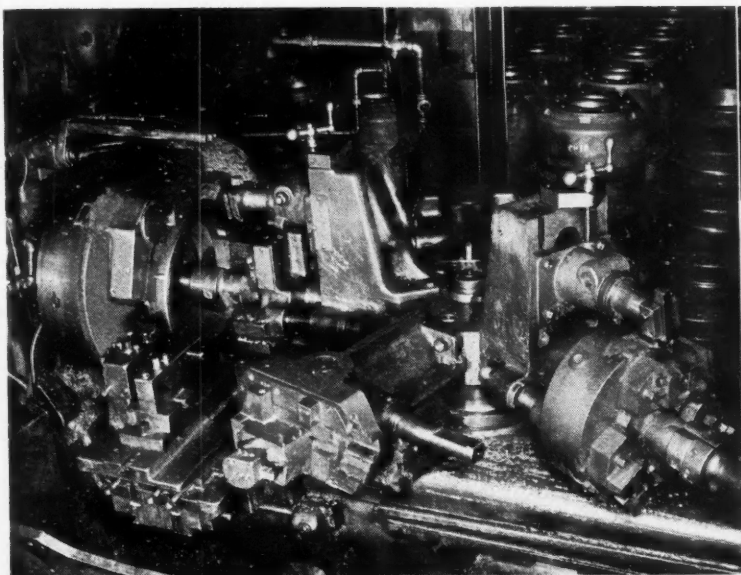
fense plants in various parts of the country.

Perhaps the finest compliment that could be paid to Timken is the statement by the Detroit Ordnance office to the effect that the first contract for high speed adapters for artillery carriages was completed 113 days before the contract delivery date. This was achieved with their own initiative, reflecting great credit on the cooperative spirit of the organization



*This is the final assembly of the bogie for the 155 mm M-1 gun carriage.*





*(Top right) This big 3000-ton Maxipress, used for making a variety of forgings, is one of the newly acquired machines in this plant.*

*(Top left) Intimate view of the 6 DREL Potter & Johnston turret lathe used for boring, turning, facing, and chamfering operations on brake drums. All roughing and finishing cuts are taken in one chucking, using an air chuck with suitable control which reduces the gripping load, automatically, for the final finishing cut.*

*(Next to top) Here is a close-up of the high speed adaptor for the 155 mm. Howitzer.*

*(Next to bottom) Grinding brake linings true with spindle bearings. This equipment was designed and built by Timken.*

*(Bottom) Spindle ends of the axle beam for the high speed adapter are ground to precision limits on the huge 23 x 120 in. Norton grinder.*

as well as its state of preparation for the job.

It must be noted that these achievements are not a matter of fortuitous circumstances. Since the previous war Timken has recognized that the rigid tests required on government axles would of necessity produce the best axles obtainable and have therefore worked very closely with the War Department on axle design. With this as a background, the shift from commercial axles to government specifications was comparatively easy and allowed them to get into high geared production on fairly short notice.

With respect to its manufacturing fa-

cilities, Timken has made it possible to utilize to the maximum extent all of its existing equipment. Advance preparation enabled the company to swing into national defense work without delay, and without creating a drain upon the new machine tools needed so badly on many new projects. An example of adapting existing machines on hand and not demanding a new machine is shown in one of the illustrations. This is an ordinary engine lathe with cam block arrangement rigged up on the carriage to turn the spindle end on the High Speed Adapter Beam. This method avoided the necessity of a new, large Fay or Lo-Swing.

Here and there in the program they have acquired certain items of modern machinery to supplement the existing facilities. Among these are the following—Lo-Swing lathes, Fay automatic lathes, Norton grinders, W. F. & John Barnes boring machines, large Milwaukee milling machines, Sundstrand lathes, Gleason Revacycle gear cutting machines, Oilgear presses, etc. The process of acquiring new equipment is proceeding wherever feasible.

War Department contract work has been spread into every department of the plant, running concurrently with commercial output of similar character. Perhaps one of the most interesting spots, apart from the machine shop activity, is the high speed axle assembly line which features a newly built merry-go-round assembly line. This is serviced by an overhead feeding monorail and compares in efficiency and productivity with any line of this kind to be found in the industry.

Supplementing these facilities is a separate building set aside exclusively for the fabrication and final assembly and packing of War Department items such as the bogies, fifth wheel assemblies, wheel and brake assemblies, etc. It includes an excellent welding department employing the latest type of Lincoln Electric Co. portable arc welding equipment. Several interesting arc welding jobs are handled here. Consider for example the fabrication of the massive "arch" axle for the 155 mm. howitzer bogie assembly. This is a huge steel casting of U-beam section. Before machining, the open outer sections are fitted with flame cut plate forms which are arc-welded to the casting, using the Lincoln welders. This produces an extremely rigid and strong U-formed unit of light weight.

## Factory Routing—Brake Drum

### OPERATION AND EQUIPMENT

**ROUGH BORE** i.d. and hub hole, **TURN** flange and chamfer, **FACE** inner and outer back face and **CHAMFER**, **FINISH BORE** i.d. and hub hole and chamfer and **TURN** **FLANGE** and finish, face inner and outer back face  
6 DREL P&J  
**GRIND** inside diameter of drum  
Cincinnati grinder  
**DRILL** and **BURR** (5) 17/32 in. holes  
Nateco multi. drill  
**SPOTFACE** (5) 17/32 in. holes to clean up only  
Cincinnati drill  
**DRILL** and **TAP** inspection cover hole  
Hoefler drill  
Remove inspection hole **BURR**  
Bench  
**INSPECT** and mark high side

## Factory Routing—Torque Rod End Pin

### OPERATION AND EQUIPMENT

**NORMALIZE** (first)  
**NORMALIZE** (second)  
**PICKLE**  
**CENTER**  
Automatic star centering machine  
**TURN** ball, **TAPER** and **THREAD** end  
Model LR Lo-Swing lathe  
**THREAD**  
Murchey 2-spindle threader  
**INSPECT**  
**LOAD** in furnace  
Bellevue furnace  
**UNLOAD** furnace and **QUENCH** in oil  
Bellevue furnace  
**WASH**  
Wash tank  
**LOAD** in draw furnace  
Homo furnace  
**DRAW**  
**UNLOAD** draw furnace  
Homo furnace  
**INSPECT**  
**SPOT** for Brinell  
Grinder  
**CLEAR** centers  
Speed drill  
**REMOVE SCALE** before rubberizing  
Grinding stand  
**GRIND** taper  
Cincinnati Centerless grinder  
**INSPECT**

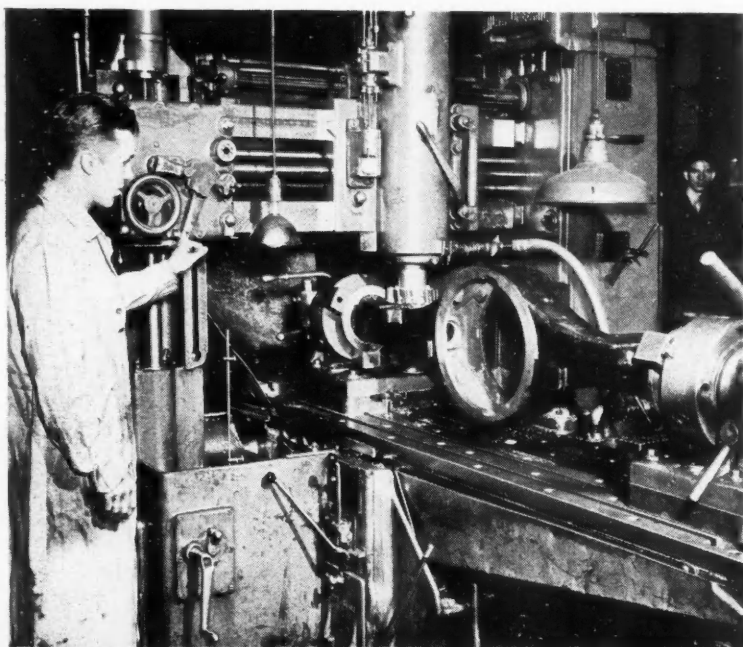
The same equipment is employed for fabricating the large draw bar entirely from flame-cut steel plate.

Machine butt welding and arc welding are employed widely in the fabrication of rear axle housings, trailing axles, bogie axles, etc. For example, the bogie axle for the 90 mm. anti-aircraft gun carriage is made up by butt welding large ends directly to the massive center section, then ring welding the large arm forging.

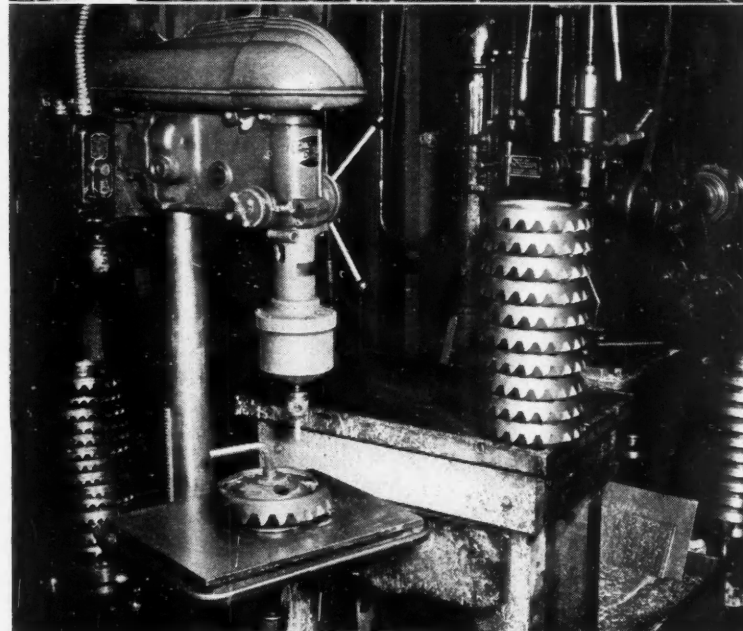
The familiar General Electric rotary arc welding machine with its four automatic welding heads is used for welding two flanges simultaneously to the tubular member of trailing axles. The same machine, with changes in the location of the heads, is used for arc welding other types of axles. A Swift resistance welding machine takes care of many butt-welding jobs.

Another of the new acquisitions is the 3000-ton National Maxipress for all manner of coining and finishing operations on various forgings, to accurate dimensions, semi-hot or cold, ready for the machine shop.

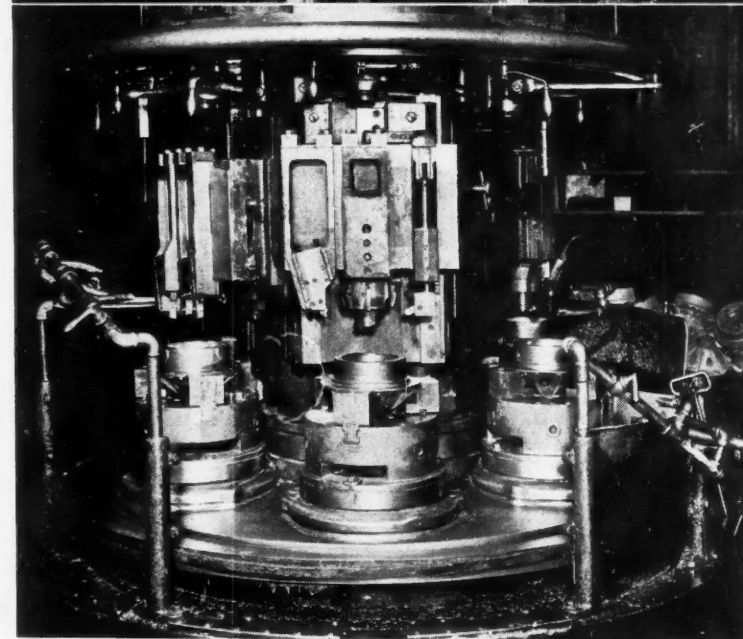
Always progressive in its methods of fabrication, Timken is driving its productive equipment at the very peak of efficiency. Even a cursory trip through the gear cutting department will make this plain. CHIPS—an unfailing index of this—come off in unusual thickness and at high speed. Many of the roughing cuts run from 1/8 in. to 1/4 in. in thickness, hogging out the forms in a single handling for the finishing operations. The new Revacycle Gleasons are marvels of productivity, producing finely finished gears in one setting from the blank, the cutter doing the roughing and finishing in a single revolution.



(Top) Mil-Waukee-Mil—K & T bridge type milling machine is tooled for milling the "hard-to-get-at" surfaces on large rear axle housings.



(Center) Timken has found it expedient to utilize the versatile Delta drills for many operations. This shows an 18 in. Delta drill fitted with a Procunier tapping head for sizing the threaded holes in spiral bevel drive gears.



(Bottom) Close-up of the work station of a 12 in., six-station Bullard Multi-Au-Matic for machining differential cases. Timken has a large battery of Bullards in various departments.

Steel cutting has been speeded beyond conventional practice by an extensive application of Ramet steel cutting tools of cemented-carbide composition, on a wide variety of forgings and steel castings, primarily on roughing operations, with speeds ranging from 175 to 350 fpm., and depth of cut from  $\frac{1}{8}$  in. to as high as  $\frac{3}{8}$  in. on tough alloy steel forgings.

In view of the many thousands of parts made in this plant, it is obviously impractical to cover more than a brief sampling of the general activity. For this reason, we have reproduced factory routings of a few typical parts illustrative of the character of operations. This group includes—the torque rod end pin, a brake drum, and a differential side gear.

The differential side gear routing gives the general picture of the operations in the gear department, and covers the new Gleason Revacycle machines. These Revacycle machines are of three-spindle type, permitting the loading of a blank and unloading of a finished gear while one is cutting.

Perhaps one of the most impressive of the operations on the torque rod pin is that of turning the forging in one setting on a Model LR Lo-Swing automatic lathe. The machine is fitted with seven tools, tipped with Ramet, the three tools on the front carriage completing the entire contouring, one for each step. These are single-point tools, the forming being done by guiding with a cam bar on the carriage. Four tools on the back slide are operated simultaneously, feeding forward to face and chamfer the ends, face the shoulder, etc.

Large brake drums, of nickel-alloy iron, are turned and bored in one chucking on a large 6 DREL Potter & Johnston turret lathe, illustrated here. Drums are held securely in an air-operated chuck, and the air pressure is automatically reduced on the finishing cuts which produces trueness of turning and boring.

It is of interest to note that Timken has



## Factory Routing—Differential Side Gear—Revacycle

### OPERATION EQUIPMENT

**LOAD** furnace for normalizing  
Pusher furnace  
**UNLOAD** furnace after normalize  
Pusher furnace  
**SHOT BLAST**  
Pangborn bbl.  
**COUNTERBORE** and **CHAMFER** i.d. at tooth end, face  
chamfer i.d. at hub end, broach spline  
Oilgear vert. broach (2) S.S. drills  
**TURN** hub & face end, turn back face, turn tooth angle  
and back angle  
Hydraulic press and Fay automatic  
**BURR** splines  
Air press  
Green **GRIND** hub o.d. and back face  
Norton grinder  
Rough and finish **CUT** (20) teeth  
No. 6 Revacycles (2 machines)  
**BURR** (20) teeth  
Bench

### OPERATION AND EQUIPMENT

**DRILL** and **CHAMFER** two  $\frac{1}{8}$  oil holes  
2 spdl. L&G drill  
**INSPECT** and stamp  
**PACK** in carburize box  
**LOAD** box in carburize furnace  
Furnace  
**UNLOAD** carburize furnace, unpack pot, quench on plug  
on conveyor and press out plug  
Furnace conveyor and press  
**LOAD** draw furnace  
Homo furnace  
**UNLOAD** draw furnace and wash  
Homo furnace  
**SHOT BLAST**  
Pangborn bbl.  
**SCLERESCOPE**  
**GRIND** back and hub  
Landis  
**DEGREASE** and **LUBRICATE**  
Plating machine  
**INSPECT** (match and wire with pinion and dip in oil)

a very large battery of Bullards, including Multi-automatics and the familiar V-T-L machines. Some of the best examples of the productivity of the Bullard Multi-automatic are found in the finishing of big ring gear blanks, differential cases and carriers. These, if they are cast steel or forgings, are tooled with Ramet steel cutting cemented-carbide tips.

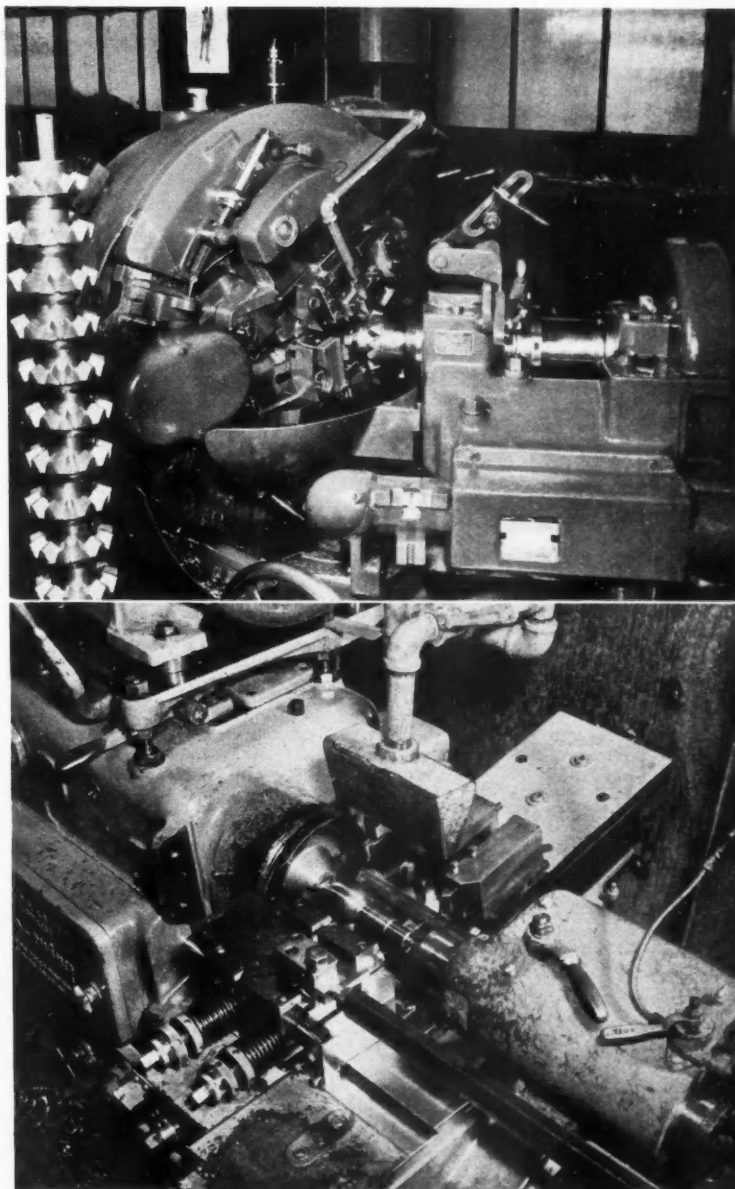
One of the illustrations shows the grinding of bearing pilots on the end of the big beam axle for the 155 mm. howitzer bogie, on a huge Norton grinder. This is an unusually difficult part to grind due to its length—88 $\frac{5}{8}$  in. overall—and the exceptionally fine tolerances demanded on its dimensions. The long cylindrical portion of the beam, about 65 in. in length, is ground to a tolerance of a few thousandths of an inch. The bearing ends are finished to within 0.0005 in.

Consider a few operations on the rear axle housing. We have reproduced a view of the W. F. & John Barnes single-spindle boring machine which bores the pilot for the carrier, using a large boring cutter with inserted teeth. Immediately above and outside the cutter is a group of single-point tools, cam-operated, for facing the top surface simultaneously.

In addition, there are two of the large K & T Mil-Waukee-Mils, known as bridge mills, one of which is illustrated. These machines are used for milling various sur-

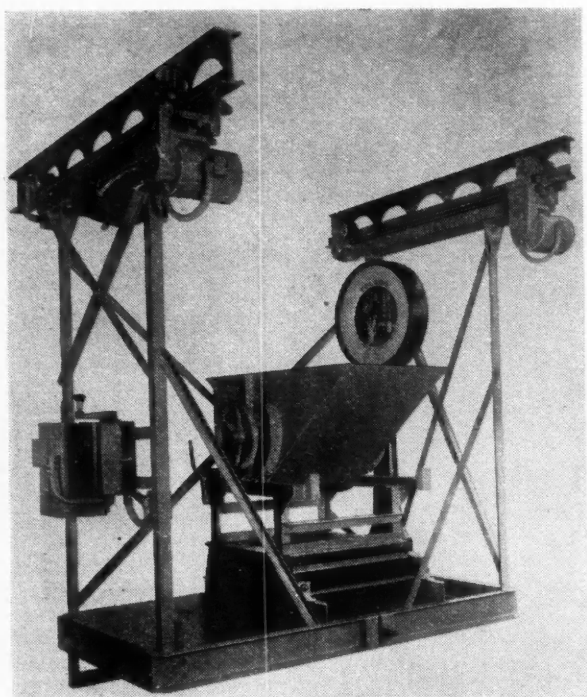
faces on the housing proper.

Finally, it is appropriate to make some further comment on the steel cutting practice with Ramet-tipped (Turn to page 77, please)



(Top) Teeth of the large double-hub Hi-Traction differential side gears are cut on a No. 12 Modified Roll Gleason Generator. It is claimed that Timken is the only producer to employ this type of equipment.

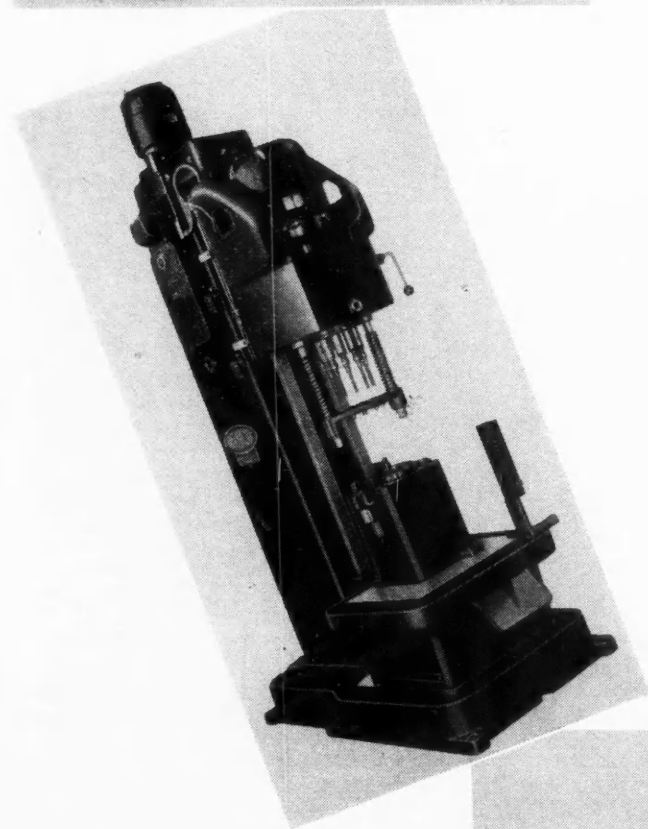
(Bottom) Model LR Lo-Swing automatic lathe is used for forming torque rod ball pins completely from the rough forging. All of the tools on this set-up are tipped with cemented-carbide of the proper steel cutting grade.



(Top) Cleveland Tramrail traveling batch scale car of half-ton size

(Above Center) Bradford Holemaster hydraulic drilling machine equipped with two-speed multiple head

(Right) Landis Type D radial crank grinder



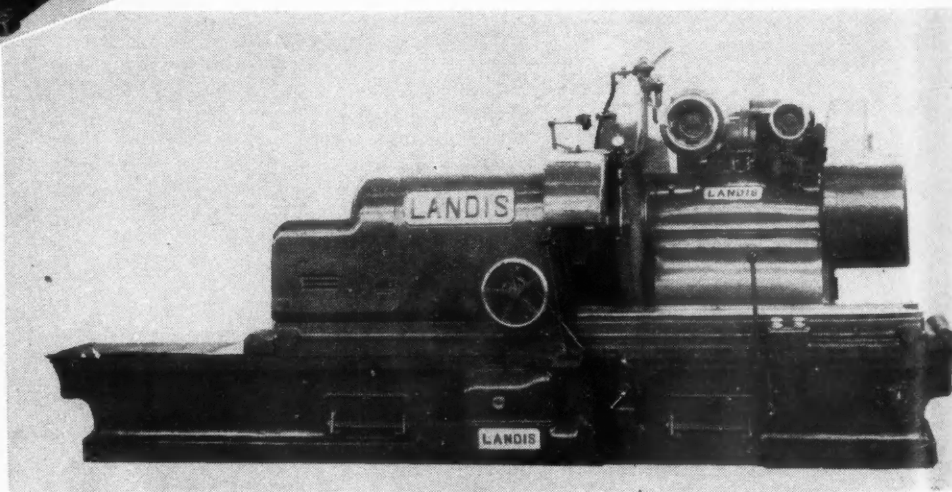
**S**ENECA FALLS MACHINE CO., Seneca Falls, N. Y., now offers the Special Star Engine Lathe equipped with special legs and a motor drive unit for use in mobile repair trucks. Originally built for the U. S. Army service trucks, this unit provides a lightweight engine lathe capable of handling work with large diameter flanges and also for repairing jobs on rifles, guns, tank and truck parts.

The general specifications are as follows: swing over bed (actual),  $14\frac{1}{8}$  in.; swing over gap, 21 in.; distance from spindle nose to end of gap,  $7\frac{1}{4}$  in.; swing over carriage,  $8\frac{1}{8}$  in.; hole through head spindle,  $1\frac{1}{8}$  in.; spindle speeds, 8; distance between centers, 36 in.; approx. weight with motor drive unit, but not including motor or equipment, 1700 lb. (Illustrated on the facing page.)

**C**LEVELAND Tramrail Division of Cleveland Crane & Engineering Co., Wickliffe, Ohio, has developed a traveling batch scale car that can be adapted to the handling of chemicals and batch materials in various industries. The car is motor driven and has a speed range up to 300 ft. per min. The scale on the car weighs the ingredients as they are dumped in the bucket, which is emptied easily by tilting through use of the crank wheel. Double overhead rails make it possible to straddle bins.

**B**RADFORD MACHINE TOOL CO., Cincinnati, Ohio, has placed on the market a line of Holemaster hydraulic drilling and boring machines which are built in a range of sizes from 5 to 30 hp. capacity. They are electrically controlled and a constant volume, vane type rotary pump supplies the pressure to the hydraulic system. They are equipped with semi-automatic hydraulic feed. (Illustrated on this page.)

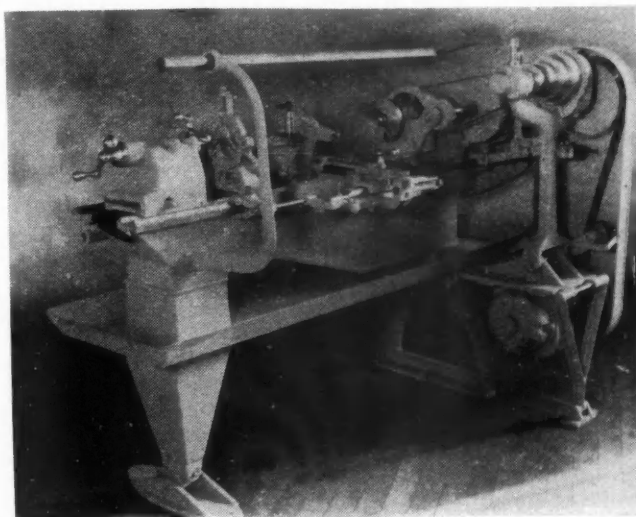
**A** NEW line of universal grinding machines in 14 in., 16 in. and 18 in. swings and 36 in., 48 in. and 72 in. between-center lengths for each swing, has been announced by Cincinnati Grinders, Inc., Cincinnati, Ohio. The table is powered hydraulically and has variable traverse rates of 3 in. to 220 in. per minute.



The power table stroke may be set as short as  $\frac{3}{32}$  in.

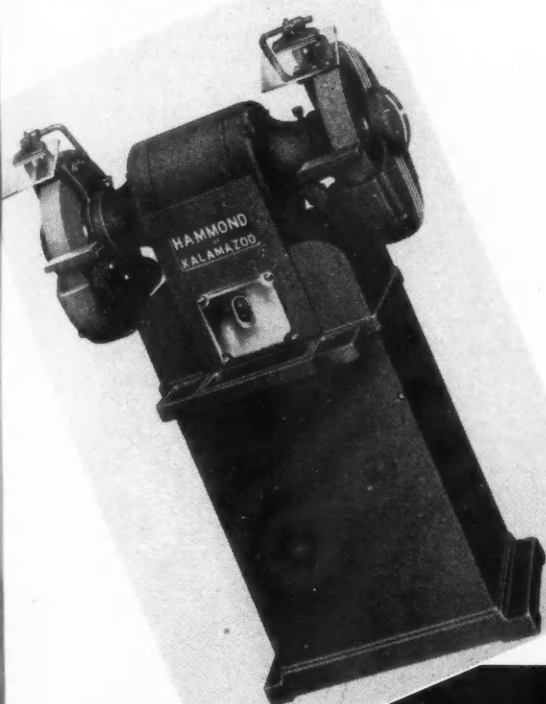
The hand table traverse has two speeds, with  $\frac{1}{10}$  in. per turn of handwheel for close adjustment and grinding shoulders, and  $\frac{15}{16}$  in. per turn for setting up. The hand cross traverse has a two-speed arrangement, .050 in. per turn of the handwheel in low gear and .250 in. per turn in high gear. The automatic pick feed may be set for one to seven notches on the cross feed handwheel, reducing the work diameter .0004 in. to .014 in. Incorporated in the headstock is a new type of drive that permits speeds from 25 to 225 r.p.m. If desired, an optional range of 40 to 360 r.p.m. may be obtained. (Illustrated on this page.)

(Turn to page 68, please)

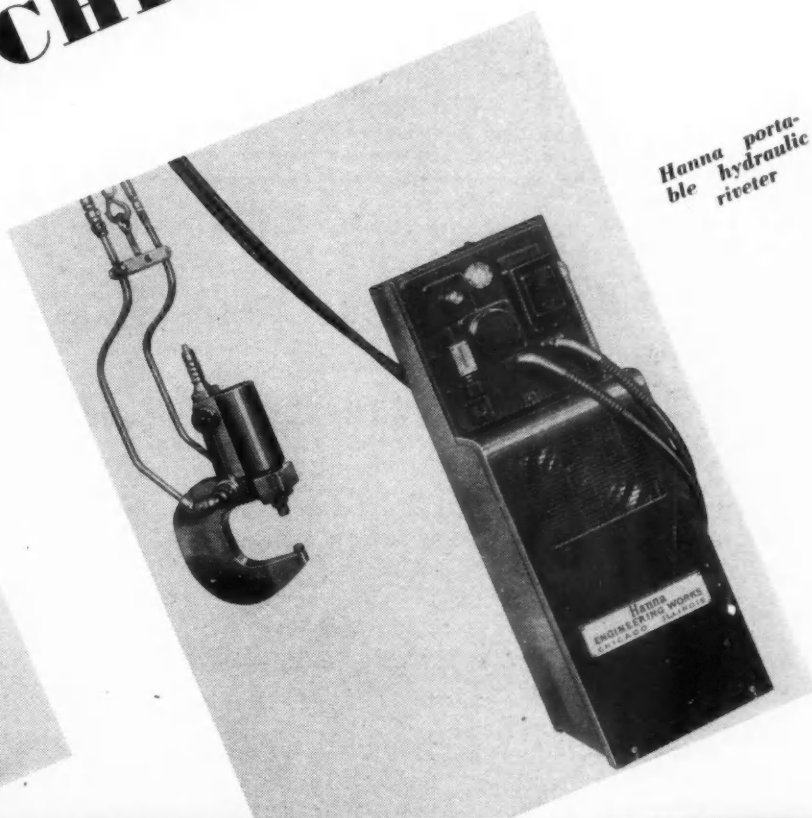


Rear view of Seneca  
Special Star engine  
lathe for mobile  
service

# MEN and MACHINES



Hammond "OK"  
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Cincinnati 16 in. by 72  
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## WHAT THE INDUSTRY IS DOING

[Our own view of automotive production and sales;  
authoritative interpretation of general conditions]

**A**SSURED of an output of 817,000 passenger cars for the first four months of the 1942 model year, the automobile companies are completing their re-tooling for the new models and getting the pilot models off the line. Five manufacturers already are in quantity production, while the others will reach that stage during September.

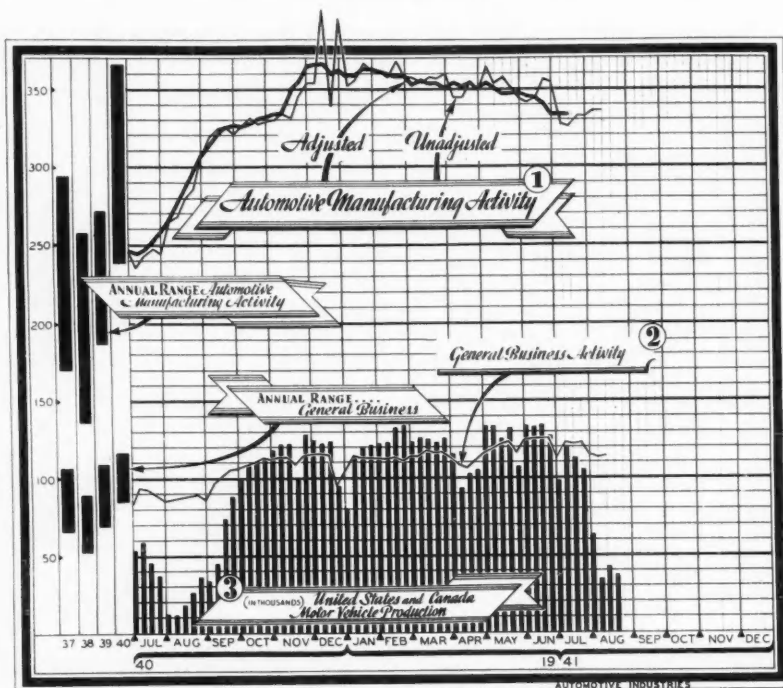
The 26½ per cent cut in passenger car output was not considered too drastic by the industry, although some had been hopeful that 20 per cent would be the limit for the opening months of the '42 model year. However, the limitation to 817,000

passenger cars through November is no guarantee that many vehicles will be built. The raw materials situation is still a restricting factor, so incipient shortages of steel, copper, nickel and other necessary metals may cut production below the OPM quota.

Passenger car output in August was approximately 90,000 units, which, deducted from the four-month quota, leaves 727,000 vehicles to be turned out in September, October and November. This is an average of 242,300 passenger cars per month for the three months against an approximate average of 350,925 passenger cars per month for the same period in the 1941 model year.

August production in the U. S. and Canada was estimated at 155,000 units, the largest for the month since 1937, and 71 per cent greater than the 89,866 vehicles turned out in August, 1940. Ford accounted for more than one-third the month's total as the company continued 1941 model production until the end of the month. Plymouth was the only other large-scale producer in 1942 production.

<sup>1</sup> 1923 average = 100; <sup>2</sup> Prepared by Administrative and Research Corp. of New York. 1926 = 100; <sup>3</sup> Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.



Weekly Indexes of Automotive General Business

## August Passenger Car Output at 90,000 Mark

Studebaker followed Hudson in that order.

Although the initial 1942 models displayed to dealers have as much or more brightwork and trim as the '41 cars, it is quite possible that this may be reduced in quantity or eliminated entirely. At a meeting of the industry with OPM in Washington, it was agreed to eliminate virtually all decorative trim and to use substitutes for critical materials in non-functional parts. This would include the elimination of aluminum pistons and sponge rubber in upholstery.

The position of some companies, which have sufficient brightwork or aluminum pistons on hand for their 1942 model requirements, remains to be clarified. An inventory of company stockpiles for submission to OPM is under way. It is possible that material shortages may bring about body trim changes part way through the model year.

Retail sales continued to reach high levels. Consumer deliveries of Chrysler Corp. in the U. S. for the first six months of 1941 totaled 686,112 vehicles, a 34 per cent advance over the first half of 1940. General Motors retail sales for July were 195,475 units, a 35 per cent gain over the same month of 1940. Studebaker July sales totaled 13,503 units, the greatest for the month since 1923 and up 50 per cent from a year ago.

Output for the week ending August 23 was estimated at 37,600 units, but this was expected to drop to 32,000 units for the last week of the month, the lowest week's total in more than a year, as Ford tapered off on '41 assemblies. Ford accounted for 14,300 cars and trucks in the week ending August 23, while Chrysler produced 8,500 and General Motors manufactured 1800, mostly Chevrolet trucks. Hudson topped the independents despite a one-day shut-down due to a labor shortage created by the municipal transportation strike in Detroit. Packard, Willys, Nash and



# Plymouth

*Broad fenders, wide grille bars and massive bumper add beauty to the Plymouth front end design. An aircraft-style air scoop is located beneath the bumper.*

Convertible Coupe, Town Sedan and Station Wagon. The first three are also available in the Plymouth Deluxe

**P**OWERED by a 95-hp. engine, the '42 Plymouths have a new appearance of greater lowness and width that is emphasized by the broad fenders, long horizontal grille bars and massive bumper design. Between bumper and grille is a broad splash guard that helps keep mud from splashing on the front of the car. Underneath the wide, heavy bumper is an aircraft-style air scoop, which adds to the high efficiency of Plymouth's cooling system. Separate parking lamps are an integral part of the grille design.

The effect of unusual lowness is achieved by lower roof lines and the 117-in. wheelbase, at the same time retaining normal headroom. Also, the body is widened to enclose and conceal the running boards. The low floor is level with the running boards. Front seats are adjustable over a 5-in. range.

There are two lines, the Plymouth Deluxe and Plymouth Special Deluxe. Special Deluxe models come in eight body styles—Coupe (3 passenger), 2-door Sedan, 4-door Sedan, Club Coupe for 6 passengers,

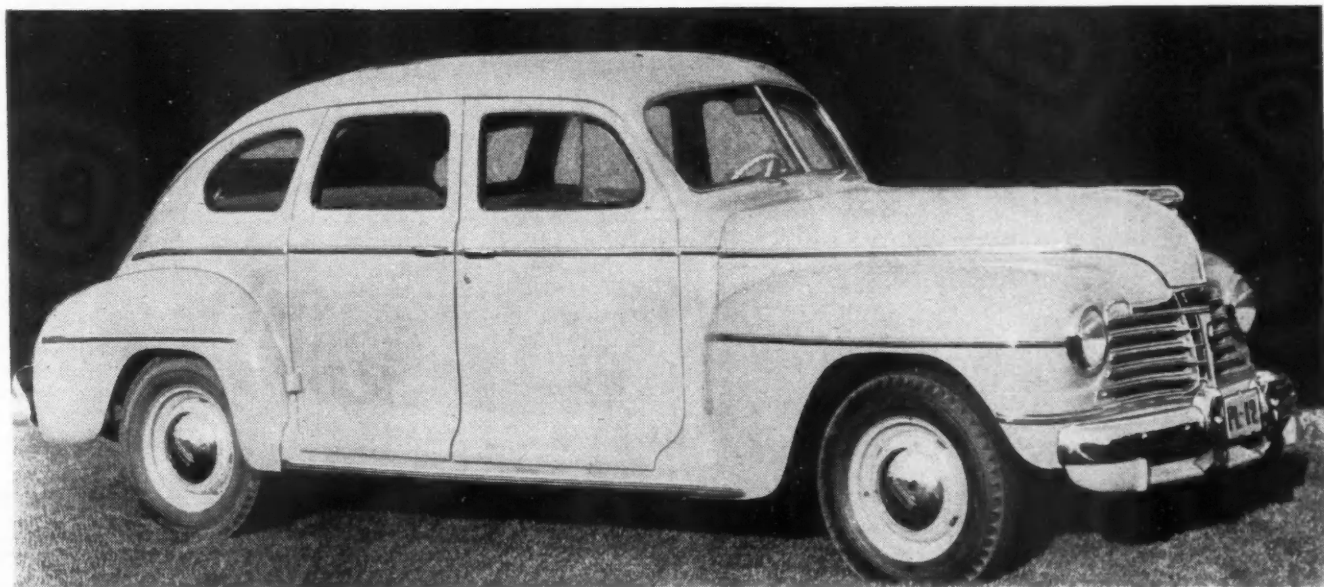
*Greater lowness and width are among the outstanding exterior appearance features of the 1942 Plymouth design. This car is the Special Deluxe 4-Door Sedan.*

line for the 1942 selling season.

Savings in fuel consumption and greater performance are improvements contributed by the 95 hp. engine. Increased output of 95 hp. is obtained at a lower engine speed, 3400 r.p.m., which permits the use of a lower rear axle gear ratio of 3.9 to 1. Also contributing to fuel economy is a higher compression ratio of 6.80 to 1. Improved smoothness of engine operation is attained with a heavier counterweighted crankshaft and a special vibration damper. The engine is equipped with lightweight iron pistons. They are specially designed with chilled iron ribs reinforcing the piston walls to make them exceptionally strong and free from distortion.

Also important in improved basic design is Plymouth's double channel frame. It is longer and more massive than the previous frame, carrying the entire body at a lower level.

Many conveniences and safeguards are included in Plymouth's  
(Turn to page 48, please)



## Detroit Exhibit Speeds Defense Contract Service

**Manufacturers Found for 70 Parts of Wright Engine Made by Continental Motors; More Orders to Automotive Companies**

A notable success in getting subcontracts placed was achieved by the Detroit office of the Defense Contract Service when manufacturers were found for approximately 70 parts of the Wright Whirlwind 450-hp. radial tank engine which is being made by Continental Motors Corp. A display of the parts for which subcontracts were sought was set up by the DCS at its office and Continental engineers were on hand to explain any details to manufacturers who visited the exhibit. Representatives of several hundred companies came to the display over a two-week period and found it much more helpful than just perusing blueprints.

Work to be subcontracted included the machining of aluminum castings, steel forgings, cylinder barrels, cylinder heads, crankshafts, connecting rods, crankcases, small gears and miscellaneous small parts. Continental is furnishing all castings, forgings and raw stock.

Success of the display probably will result in use of similar exhibits at other of the Defense Contract Service's 36 offices around the country to stimulate subcontracting on defense orders. Joseph L. Trecker, co-chief of the subcontracting unit of DCS, was a visitor

at the exhibit and was impressed with the results achieved.

Continental recently completed rehabilitation and retooling of its old Detroit plant for the manufacture of tank and aircraft engines but these facilities were not extensive enough when the government upped its monthly production quota on Wright tank engines from 600 to 1100 per month. This necessitated the location of subcontractors for a number of parts.

William S. Knudsen, director of OPM, announced recently that there were 14,000 companies holding primary defense contracts and approximately 65,000 to 70,000 with subcontracts. An OPM report several months ago revealed that there were 11,099 subcontractors in the Detroit area alone.

### Chrysler Tank Engine

Chrysler Corp., which is building all but the engine of the 31-ton medium tank at its new Tank Arsenal near Detroit, may enter the engine field, too. In his six-month report, President K. T. Keller revealed that Chrysler engineers are experimenting with a 500-hp. liquid-cooled tank engine. Chrysler-built tanks are now powered by 450-hp. Wright Whirlwind air-

*(Turn to page 54, please)*

## Federal Taxes Dig Deep Into Company Earnings

Of their earnings for the first half of this year, seven automobile companies set aside 59 per cent for Federal income tax reserves as compared to 32.3 per cent for the same period in 1940, according to an analysis of their statements by The Conference Board. Before Federal taxes, their increase in earnings for the first half period in 1941 was 76 per cent greater than in 1940, but after Federal taxes, their net income was only 6 per cent higher this year than in 1940.

Nineteen automobile parts manufacturers charged off almost 54 per cent of their earnings for Federal income taxes, and in 1940 the percentage was 28. Before taxes, their income was 80 per cent greater and after taxes 15 per cent greater than in 1940.

### Aircraft Net Income Less

Six companies manufacturing aircraft and parts set aside 67.5 per cent this year as against 21.1 per cent last year, so that net income after taxes was 6 per cent lower than in the first half of 1940, although before taxes earnings were 127 per cent higher than last year. Federal tax reserves for these six companies amounted in all to \$28,470,000, as compared with \$3,923,000 in the first half of 1940; net income after taxes amounted to \$13,727,000, as compared with \$14,681,000 in 1940.

The survey covered 275 industrial companies in the following classifications: aircraft and parts, automobiles and parts, building materials, chemicals, electrical, food, machinery, paper, petroleum, rubber, steel and iron, and textiles. This year these companies in the aggregate set aside 51.6 per cent of their earnings for Federal taxes as compared with 26.7 per cent last year, so that their net income after taxes was only 20 per cent higher than last year, despite before Federal taxes the increase in earnings was 82 per cent.

## Cancel Detroit Show

For the first time in 41 years Detroit will have no automobile show. The forty-first annual show, tentatively scheduled for October, recently was canceled when the board of directors of the Detroit Auto Dealers Association voted to table the matter for an indefinite period due to the desire to cooperate with the manufacturers and the OPM in furthering defense.

### Theodore E. Barker

Theodore E. Barker, Chicago, founder of the American Society for Metals, died Aug. 15 at Atascadero, Calif.



### Detroit OPM Exhibit

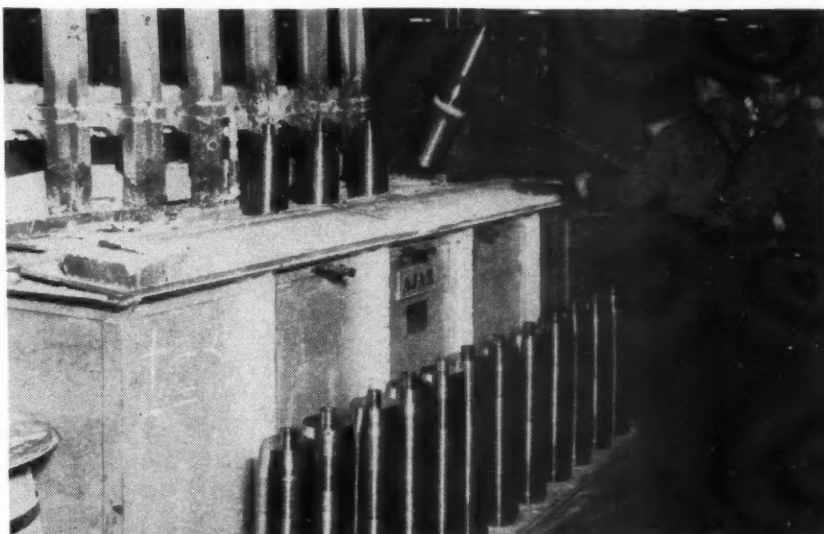
OPM officials are examining parts of the Wright radial engine for tanks at the Detroit exhibit to interest small manufacturers in subcontracts. Left to right: Warren H. Clarke, Clarence W. Avery and Joseph L. Trecker.



## CALENDAR

### Conventions and Meetings

Natl. Petroleum Assoc., Atlantic City, Sept. 17-19  
Society of Automotive Engineers, National Tractor Meeting, Milwaukee, Sept. 25-26  
Natl. Lubricating Grease Inst., Chicago, Sept. 29-30  
Natl. Safety Council, Chicago, Oct. 6-10  
Exposition of Power & Mechanical Engineering, Chicago, Oct. 6-11  
Amer. Society of Tool Engineers, Toronto, Canada, Oct. 16-18  
National Metal Congress and Exposition: Cooperating societies—American Society for Metals, Wire Association, American Welding Society, Institute of Metals and Iron and Steel Divisions of American Institute of Mining and Metallurgical Engineers, Philadelphia, Oct. 20-24  
SAE Natl. Fuels & Lubricants Mtg., Tulsa, Okla., Oct. 23-24  
Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles, Oct. 30-Nov. 1  
SAE West Coast Transportation Mtg., San Francisco, Nov. 5-6  
SAE Natl. Transportation & Maintenance Mtg., Cleveland, Nov. 13-14  
National Assoc. of Manufacturers, New York City, Dec. 3-5



### Shells from Willys-Overland

Mass production techniques are called into play at the Willys-Overland plant, Toledo, for the manufacture of 155-mm. shells for the Army. The operation pictured here might be termed "putting the heat on" potential U. S. enemies. After preliminary turning operations, the shell forgings are prepared for "nosing" or "pointing" by an

immersion in a bath of liquid barium chloride, which is electrically heated to a very high temperature. A few minutes of this immersion brings the nose to a dull red glow, after which, as shown in the picture, it is lifted out and placed in the press, which will squeeze the nose shut and so produce the familiar "bullet" shape.

## UAW-CIO Sets Goal of Million Members by 1945

### Referendum on \$1 per Capita Assessment to Be Held by December 1; Chicago and New York Shops Major Objectives

Setting its goal as 1,000,000 members by 1945, the UAW-CIO will hold a referendum of its membership by December 1 on a \$1 per capita assessment for organizational purposes during the next year. Affirmative action on the assessment would mean a war chest of over \$500,000 for organizational campaigns in the aircraft, farm implement, competitive shop, tool and die, battery and Diesel industries. This action was voted at the recent annual convention of the UAW-CIO at Buffalo.

Chicago and New York will be major objectives of the expansion drive aimed at so-called runaway plants, competitive shops and replacement parts plants in those cities. Secretary-Treasurer George F. Addes estimated funds required for this work would be \$200,000 for aircraft organizing work, \$60,000 to bring in unorganized competitive shops and \$115,000 for more organizers and increased administrative expense due to the larger membership.

Adopting the anti-Nazi and anti-

Communist amendment by a vote of 1968 to 1026, the convention changed the constitution to bar from office anyone who is a "member of or subservient to any political organization which owes allegiance to any government other than the U. S. or Canadian government, directly or indirectly."

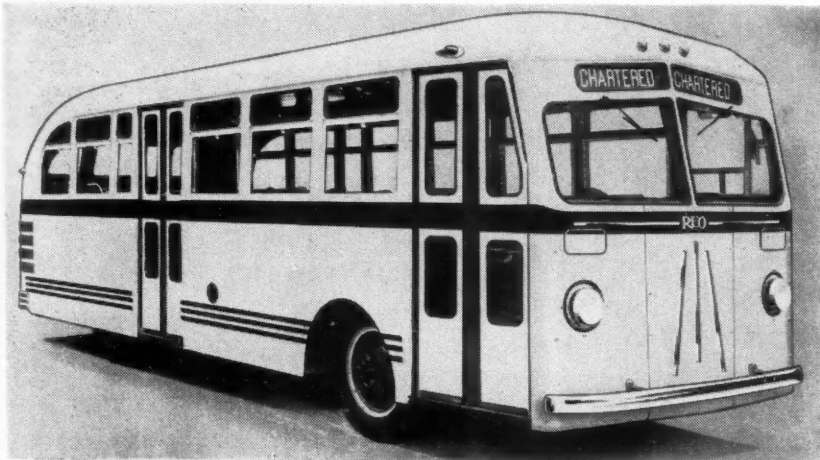
The union's international executive board was expanded from 19 to 20 members, the additional member going to the eastern region. The board now includes seven members from Michigan, three from Ohio, two from the East and one each from Indiana, Wisconsin, Missouri, the West Coast, Canada and the South. President Roy J. Thomas, who was unopposed for re-election, and Addes complete the board. Addes, secretary-treasurer for the past five years, was continued in office by defeating

(Turn to page 46, please)

### June New Passenger Car Registrations and Estimated Dollar Volume by Retail Price Classes\*

PRICE CLASS	NEW REGISTRATIONS								ESTIMATED DOLLAR VOLUME							
	JUNE				SIX MONTHS				JUNE				SIX MONTHS			
	Units		Per Cent of Total		Units		Per Cent of Total		Dollar Volume		Per Cent of Total		Dollar Volume		Per Cent of Total	
	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940	1941	1940
Chevrolet, Ford and Plymouth	229,510	175,078	51.77	55.03	1,287,694	993,947	52.22	54.82	\$189,000,000	\$133,900,000	45.62	48.83	\$1,059,522,000	\$759,900,000	48.13	48.50
Others under \$1,000	83,782	101,344	18.90	31.85	490,487	578,499	18.67	31.91	77,900,000	91,500,000	18.80	33.37	335,808,000	523,400,000	15.25	33.40
\$1,001 to \$1,500	122,031	39,781	27.53	12.50	673,559	227,919	27.31	12.57	134,000,000	44,900,000	32.34	16.37	730,252,000	257,800,000	33.17	16.45
\$1,501 to \$2,000	6,907	1,210	1.56	.38	37,014	7,976	1.50	.44	10,800,000	2,100,000	2.61	.76	58,088,000	13,900,000	2.65	.89
\$2,001 to \$5,000	1,090	737	.24	.24	7,258	4,718	.30	.26	2,600,000	1,800,000	.63	.66	17,474,000	11,500,000	.80	.74
\$3,001 and over		5				66			25,000		.01		340,000		.02	
Total	443,320	318,155	100.00	100.00	2,466,012	1,813,125	100.00	100.00	\$414,300,000	\$274,225,000	100.00	100.00	\$2,201,144,000	\$1,566,840,000	100.00	100.00
Miscellaneous	150	490			1,369	1,689										
Total	443,470	318,615			2,467,381	1,814,814										

\* All calculations are based on delivered price at factory of the five-passenger, four-door sedan, in conjunction with actual new registrations of each model. The total dollar volumes are then consolidated by price classes.



### Reo-built Coaches

A new line of rear-engined transit and inter-city coaches will be built by Reo Motors, Inc., at its plant in Lansing, Mich. Coach models are as follows—Transit Type: 33-T 25-pass.; 56-T or TD 30-pass. single door,

27-pass. two-door; 92-T or TD 34-pass. single door, 32-pass. two-door; Inter-City Type: 38-P 25-pass.; 56-P 27-pass. non-recliner, and the 92-P 33-pass. non-recliner. Wheelbases range from 138 to 192 in.

## OPM Full Control of Steel Affects Placing of Orders

*Decline in Number after Government Ruling; Rise in Tin Price at Singapore Market Attributed to Russian Buying*

By W. C. Hirsch

Steel market activities reflect the Nation's defense effort in a steadily increasing degree. Whatever changes full priority control may bring September 1, one result is already noticeable. Since the giving of advance notice of this measure by the Priorities Division of OPM, there has been a marked decline in the number of orders offered to steel producers by buyers with a weak case to back up their requests for early shipment. Such business had been previously turned down or put on the deferred list by the steel producers themselves, but now that buyers know that their orders will be analyzed and scrutinized by OPM officials, they confine their commitments to what they can prove they need to continue operating their plants. This pertains, of course, to steel wanted for non-military purposes.

The ironing out of the many problems arising from the priority regulations, such as which orders shall have the right of way over others carrying the same preference rating, will be a continuous task for the staff of the Priorities Division, but it will be well to remember that steel producers, having complied with all of its orders and regulations, and having done whatever is humanly possible to further the defense program, still have an interest in satisfying their "peacetime" customers to the best of their ability. Their patriotism does not suffer by their giving, in so far as this is possible, consideration to the maintenance of the good will enjoyed by them in normal times.

In steel, as well as in aluminum and

some other metals, projects for the further expansion of capacity have been announced. All of these plans

entail much new plant construction and it will be well into next year before operations can begin. Announcement of enlargement of the ALCOA's capacity by the construction and operation of a plant for the production of 400,000,000 pounds annually of alumina, together with three additional smelting plants of commensurate capacity, brought also the interesting news that the price of ingot aluminum will be reduced from 17 cents to 15 cents a pound on all shipments made after September 30, 1941. Prices for fabricated aluminum will be reduced by 2 cents a pound and upwards for some descriptions.

### Post-War Prices

Many market observers take this as an indication that, as the result of technical progress and plant enlargements made possible by the mass demand for defense, post-war prices of many metals are likely to be revised downward. Priorities control has been extended to vanadium, which is used as an alloying agent in the making of steel forgings and high-speed and heavy duty tools. The metal comes chiefly from South America and South Africa. About 3,750,000 pounds will be available this year, but, according to OPM officials, the demand will reach 5,900,000 pounds. It is now learned that a good deal of the hue and cry about scrap shortage results from the con-

(Turn to page 56, please)

### Exports and Imports of the Automotive Industry for June

	JUNE				SIX MONTHS ENDED JUNE			
	1940		1941		1940		1941	
	No.	Value	No.	Value	No.	Value	No.	Value
<b>EXPORTS</b>								
Automobiles, parts and accessories		\$ 17,660,844		\$ 21,415,033		\$ 135,133,033		\$ 159,064,099
<b>PASSENGER CARS</b>								
Passenger cars and chassis	6,309	3,933,814	3,885	3,409,562	57,319	35,616,907	43,129	30,609,415
Low price range \$650 inclusive	5,746	3,283,344	3,047	1,928,059	50,738	28,733,454	35,234	21,276,846
Medium price range over \$850 to \$1,200	476	457,765	644	630,304	5,680	5,414,715	6,489	6,252,273
\$1,200 to \$2,000	56	83,472	105	150,316	783	1,138,113	1,109	1,550,557
Over \$2,000	31	109,233	89	700,879	108	330,625	287	1,529,239
<b>COMMERCIAL VEHICLES</b>								
Motor trucks, buses and chassis (total)	8,094	6,538,331	9,394	9,078,319	58,544	47,733,208	63,243	63,153,787
Under one ton	825	374,386	701	332,424	7,774	3,533,804	5,033	2,634,089
One and up to 1½ tons	6,376	3,345,401	5,601	3,512,251	39,145	20,823,979	38,936	24,101,261
Over 1½ tons to 2½ tons	483	433,239	1,622	1,829,600	8,542	11,137,314	8,787	10,265,785
Over 2½ tons	422	2,368,190	1,460	3,399,689	3,959	12,059,386	10,432	26,088,076
Bus chassis	18	17,115	4	4,355	124	178,725	55	64,576
<b>PARTS, ETC.</b>								
Parts except engines and tires								
Automobile unit assemblies		3,245,090		4,903,109		23,014,572		35,322,536
Automobile parts for replacement (n.e.s.)		2,653,492		2,548,030		20,585,070		20,707,164
Other automobile accessories (n.e.s.)		364,458		354,405		2,345,099		2,955,692
Automobile service appliances		326,736		507,374		2,085,522		2,165,779
Airplanes, seaplanes and other aircraft (powered)	372	20,320,793	352	23,815,020	1,462	91,877,028	2,717	185,435,728
Parts of airplanes, except engines and tires (n.e.s.)		1,734,185		4,480,698		11,248,428		21,539,874
<b>INTERNAL COMBUSTION ENGINES</b>								
Stationary and Portable								
Diesel and semi-Diesel (other than automotive)	103	439,779	288	911,404	492	1,719,256	1,767	7,367,054
Other stationary and portable								
Not over 10 hp.	1,661	92,840	1,209	82,825	8,218	473,409	9,613	619,883
Over 10 hp.	143	530,392	148	227,809	1,200	1,893,156	12,481	1,393,590
Accessories and parts (carburetors)		466,733		456,966		2,348,948		2,627,789
<b>Engines for:</b>								
Motor trucks and buses	1,285	176,575	2,931	365,979	11,446	1,294,588	13,197	1,805,404
Passenger cars	1,626	132,732	926	113,797	11,169	995,184	5,717	722,981
Aircraft	314	3,122,721	478	6,520,048	2,008	17,704,362	3,862	45,737,909
<b>IMPORTS</b>								
Automobiles (durable)	57	48,673	21	8,397	302	319,894	192	116,145

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Hundreds of the brightest minds in business are getting together in September at the Royal York Hotel, Toronto, Canada, for the annual N.I.A.A. Conference.

Many of them are working now to bring you their interpretation of today's perplexing problems of industrial marketing. You could not buy this wealth of experience for a fortune.

Yet it is all yours for the price of a registration ticket, train fare and three days' hotel. Make up your mind to be in Toronto on September 17 and send in your registration now.

- It is easy for United States citizens to come and go across the border—no special forms or red tape required.

- The Royal York Hotel is the largest in the British Empire—all sessions, exhibits and panels on the one convention floor.

- Canadian industry has had to face for two years the conditions now confronting us. This experience can help to steer you straight.

- Some Subjects on the Program: Industrial Advertising

in a Wartime Economy — Institutional Advertising — Information Plus—Industry Looks Ahead — Advertising Analysis — Putting Sales Tools to Work — and many others.

*Make this note in your diary*

**19<sup>th</sup> ANNUAL N.I.A.A. CONFERENCE**  
**TORONTO, CANADA - SEPTEMBER 17, 18, 19**

**NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION, INC.**  
100 EAST OHIO STREET CHICAGO, ILLINOIS





## MEN . . . . .

H. G. Smith, former chief engineer of the automotive division of Buda Co., Harvey, Ill., has been elevated to executive engineer in charge of engineering of automotive and industrial, and radial diesel divisions.

John H. Collier, president of Crane & Co., Chicago, has been elected to the board of trustees of the Illinois Institute of Technology to fill the vacancy created by the death of C. B. Nolte.

Col. Edgar S. Gorrell, president of the Air Transport Assn. of America and one-time president and board chairman of Stutz Motor Car Co. of America, has been appointed domestic air transportation consultant to Ralph Budd, transportation com-

missioner of the Office for Emergency Management.

Douglas Ward, formerly assistant sales manager of the Irvington Varnish & Insulator Co., Irvington, N. J., has been made general manager of the company's newly created Fibron Division.

George E. Winters, formerly production manager of the Muskegon plant, has been appointed manager of both the Muskegon and Detroit plants of Continental Motors Corp. L. W. Rich, master mechanic, has been made assistant to the vice-president, Kahle Hall, formerly with Heald Machine Co., has been named factory manager of the Detroit plant and E. R. Jacoby, technical director of engineering at Muskegon, has been transferred to Detroit to assist in Wright aircraft engine production.

Dr. Willard H. Dow, president and general manager, has been elected board chairman of the Dow Chemical Co., succeeding Dr.

James T. Pardee, who resigned the post after 44 years as a member of the board.

Robert E. Griffin has been named works manager of Olds Motor Works, succeeding Sydney A. Woodmancy, retired. John Dykstra, assistant works manager, has been appointed factory manager and C. A. Blake, formerly assistant manager of the St. Louis zone, will succeed Dykstra as assistant works manager.

## UAW-CIO Goal

(Continued from page 43)

Richard T. Leonard, director of the Detroit West Side local, 1759 to 1307.

The convention instructed UAW delegates to the next CIO annual convention in November to support the reelection of Philip Murray as president. This was considered a setback to aspirations which John L. Lewis may have for regaining the CIO presidency, which he surrendered after supporting Wendell Willkie in the last presidential election. The UAW is the next strongest union in the CIO to the United Mine Workers, having 556,131 paid up members in July.

A plan for re-employment of workers laid off by the indirect effects of the defense program was carried out successfully in Buffalo by the OPM in cooperation with labor and industry. Thirty-six hundred workers in the Chevrolet engine plant at North Tonawanda, N. Y., made temporarily idle by the conversion of that plant to production of Pratt & Whitney aircraft engines, were directed to other employment. Of the total, 800 were rehired for aircraft work, 500 more were promised immediate reemployment and 225 were enrolled in retraining courses for defense jobs. In the latter role they will receive \$15 per week as unemployment compensation during training. Four other Buffalo defense plants—Bell Aircraft Corp., Worthington Pump & Machinery Co., Buffalo Arms Corp. and the Curtiss-Wright Corp.—agreed to hire all workers who successfully complete the retraining courses. This employment formula may be applied to workers in Detroit, Flint, Pontiac and Lansing who will be made idle by the 26½ per cent curtailment in passenger car production.

## 90,000 Idle Workers

Sidney Hillman, co-director of OPM, and other government officials have been working with the UAW-CIO and automobile companies in an attempt to cushion the unemployment shock occasioned by the production cut. Some estimate that 90,000 or more workers in the automobile industry will be made idle, although new defense projects and increased truck production are expected to absorb some of the workers thus out of jobs. The regular seasonal layoff in the industry due to model changeovers is reflected in current applications in Michigan for unemployment benefits, which jumped 66 per cent to 97,495 claims recently. However, some of these will not be taken back into motor car plants due to the lower production.

*When it's a question of*

**LIGHT COLOR**

*and*

**HIGH CUTTING QUALITY**



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America's First Transparent Sulphurized Cutting Oil

WHILE it is scientifically recognized that dark colored sulphurized cutting oils are superior to light colored oils for the very "tough" metal cutting operations, there are many classes of machining for which transparent cutting fluids may be used without affecting performance values. As the leading example of light colored transparent sulphurized cutting oil STUART'S "SUPER-KOOL" offers many unique and exclusive advantages:

1. Permanent sulphur content. No precipitation in drum or storage tank—summer or winter. No appreciable loss in cutting quality after centrifuging.
2. Free from the slightest objectionable odor.
3. Pale amber in color and transparent when blended with paraffin oil or equivalent.
4. Less base required to match a given standard of cutting quality and therefore more economical.
5. Recommended by foremost machine tool builders and used in thousands of metal working machines for cutting, grinding and deep drawing.

Put "SUPER-KOOL" advantages to work for you Now! Sold as a base or in ready-to-use mixtures for Steel, Brass, Bronze and Aluminum.

WRITE FOR new booklet—"Stuart Oils—The Straight Line to Metal Working Efficiency." It describes in detail many of the utilities of the highly recommended tool lubricant—"SUPER-KOOL". Free to personnel of metal working plants.

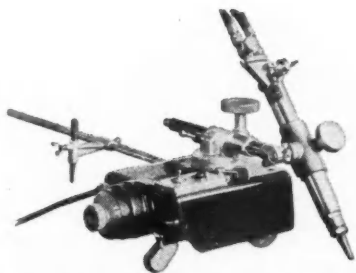
For All Cutting Fluid Problems

**D. A. STUART OIL CO.**

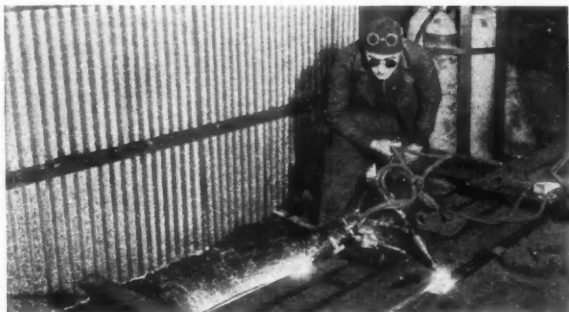
Chicago, U.S.A. • LIMITED • Est. 1865

Warehouses in All Principal Metal Working Centers

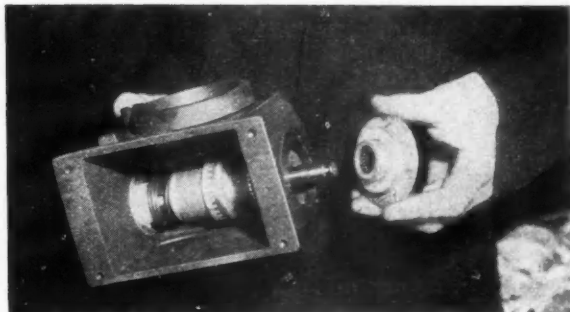




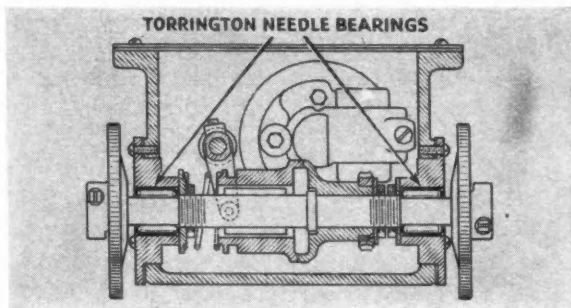
## **AIRCO** No. 10 RADIAGRAPHS RIDE SMOOTHLY ON TORRINGTON NEEDLE BEARINGS



**AIRCO NO. 10 RADIAGRAPH**, a compact, portable gas-cutting machine, is used to advantage in cutting or beveling steel sheets, plates, billets, and forgings in straight lines, circles, or arcs. Anti-friction Torrington Needle Bearings in the main running gear assembly help to assure smooth, dependable operation.



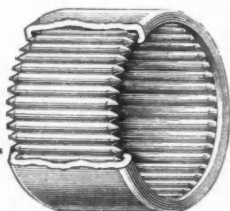
**SMALL SIZE OF THE NEEDLE BEARINGS** helps reduce size and weight of surrounding parts. They occupy no more space than a plain bushing—yet give low starting and running friction, have exceptionally high load capacity in proportion to their size, and are ideally suited for rotating applications.



**"THOROUGH LUBRICATION** for long periods of time is assured by the design of the Needle Bearing," say engineers of Air Reduction. "The efficient lubrication of the bearings, combined with their high capacity, results in long service life."



**"A SINGLE SIMPLE OPERATION** is all that is needed to install the Needle Bearing," says Airco, "effecting time and labor savings." The Needle Bearing also offers other economies through its low initial cost and the simplifications in design which it often makes possible.



Your product, too, may be improved by the unusual features and economies of the Torrington Needle Bearing. Our Engineering Department will be glad to assist you in planning its use. For full information, write for Catalog No. 107. For Needle Bearings to be used in heavier service, write our affiliate, Bantam Bearings Corporation, South Bend, Indiana, for Booklet 104X.

THE TORRINGTON COMPANY, TORRINGTON, CONN., U. S. A. • ESTABLISHED 1866

Makers of Needle and Ball Bearings

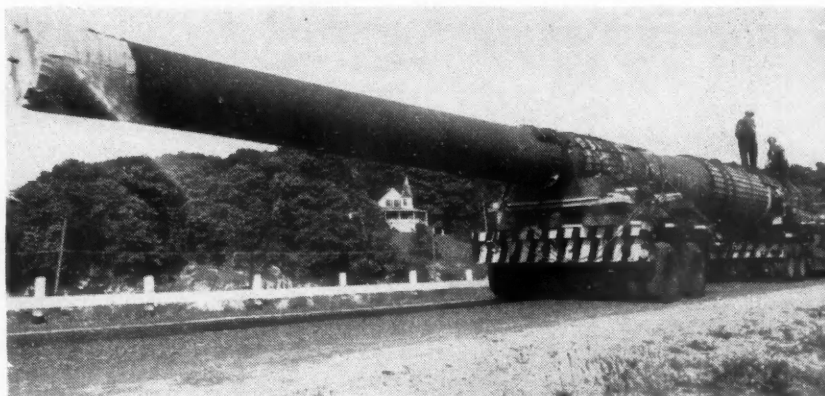
New York Boston Philadelphia Detroit Cleveland Chicago London, England



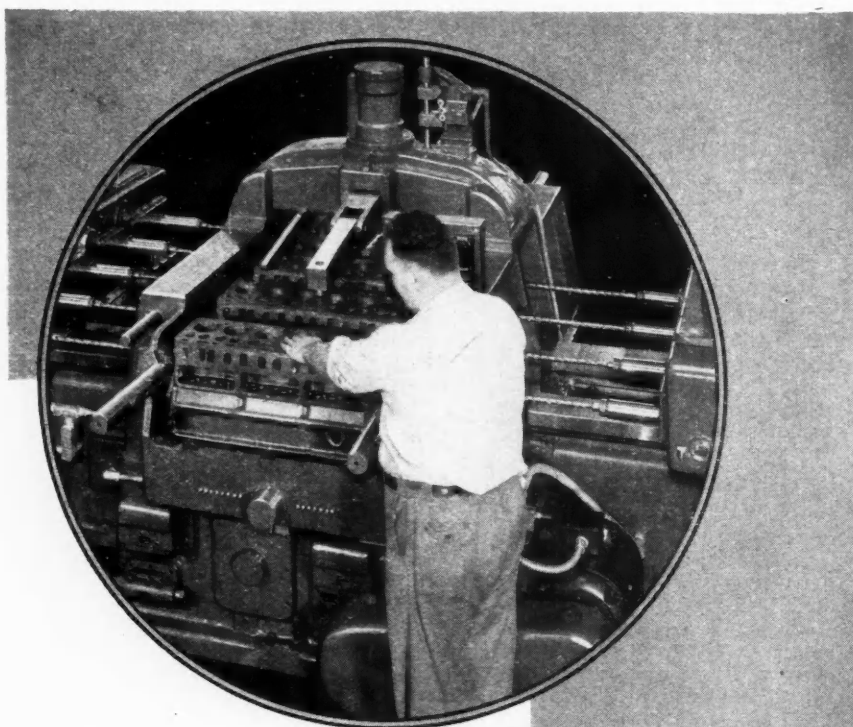
# TORRINGTON NEEDLE BEARING

## 145-Ton Monster for Coastal Defense

Transporting this huge gun to Fort Church, R. I., for Uncle Sam's coastal defense required a tractor and two trailers equipped with 38 pneumatic tires of 10.00-16, 12.00-24 and 14.00-24 sizes. Approximate speed of the haul was 2 m.p.h. The gun weighs 145 tons and is 68 ft. long.



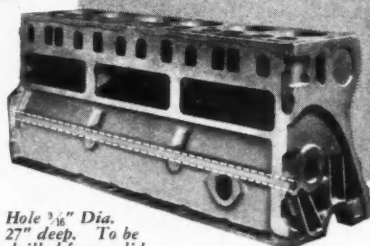
Courtesy Goodyear



## How to Drill a 5 Minute Hole in 36 Seconds

If you were called on to drill this hole in 100 cylinder blocks every hour, how would you do it? Drilling straight through with one drill and a standard machine would take five minutes — or longer. To get 100 blocks an hour you'd need about 9 machines and 9 operators.

Our analysis of the job resulted in this progress-through drilling machine. Dividing the drilling into five stations and adding an accurate horizontal index makes it possible for an *unskilled* operator to produce a completed block every 36 seconds. Salvaged drills can be used. In addition, the burden on



Hole  $\frac{3}{16}$ " Dia.  
27" deep. To be  
drilled from solid.

individual drills is less, resulting in a minimum of tool maintenance costs.

When you're confronted with the need for increased production and considering the purchase of a battery of duplicate machines, you need this kind of machine design service.

Our booklet "Since 1872 . . ." will show you how it has worked for others — send for your copy.



### W. F. AND JOHN BARNES

ROCKFORD . . . . . ILLINOIS

DESIGNERS AND BUILDERS OF DRILLING, BORING,  
TAPPING, MILLING, AND HONING MACHINES TO  
SUIT YOUR PARTS — YOUR PRODUCTION.



## '42 Plymouths

(Continued from page 41)

design. Special outside locks on both front doors can be opened at either side with the ignition key. A special hookup with the inside door handles makes it impossible to lock oneself out of the car with the key inside.

Horns will not blow until the ignition key is turned on. All models are equipped with dual air-tone horns. In Special Deluxe models, interior lights switch on automatically when the right front door is opened, and the hand-operated interior light switch is moved of the left door post. Trunk lids on all models are spring counterbalanced.

Body color options available as standard for all Plymouth models include Marine Blue, Chevron Blue, Gunmetal, Airwing Gray, Battalion Beige, Artillery Green, Pilot Green, Cruiser Maroon and Black. Two additional colors for Convertible Coupes only are Charlotte Ivory and Summac Red.

Most of the standard colors are also available in six different two-tone combinations on all 2-door and 4-door sedans, and on Club Coupe models in both lines at extra cost.



Newly-styled interiors of the Plymouths are attractive. Concealed running boards are a safety feature.





### THEY WERE SLOW ...

particularly on screw-driving operations. I decided to go to the assembly line, see what the trouble was.



### THEY WERE SORE ...

fumbled screws, crooked screws, slipping drivers, slow work...everywhere! Was it their fault? Then the truth flashed into my mind ...



### WORK WAS SPOILED ...

by slotted screws! Hand driving wasted precious time. Even then—drivers slipped, scarring work, injuring hands. No wonder morale was low!



**"WHOSE FAULT-?  
THE WORKERS', OR MINE!"**



### "TRY PHILLIPS SCREWS"

... and power drivers," I said. So we paid a little more for screws and began to save a lot in time and money. Now we ...

- start FAST with one hand
- drive FAST with power drivers
- drive FAST in awkward positions
- finish FAST without danger of slipping
- seat FAST in neat, tight assembly.

The patented Phillips Recessed Head clings to the driver. Thousands of manufacturers — in scores of industries — today are finding that it pays to pay a little more for screws ... to get Phillips' money-saving advantages in operation. For further facts, write to any of the firms listed below.

# PHILLIPS

## RECESSED HEAD SCREWS

**19 SOURCES  
of SUPPLY**



*Speed Product Deliveries by Cutting Assembly Time*

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS • SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

American Screw Co., Providence, R. I.  
The Bristol Co., Waterbury, Conn.  
Central Screw Co., Chicago, Ill.  
Chandler Products Corp., Cleveland, Ohio  
Continental Screw Co., New Bedford, Mass.  
The Corbin Screw Corp., New Britain, Conn.

International Screw Co., Detroit, Mich.  
The Lamson & Sessions Co., Cleveland, Ohio  
The National Screw & Mfg. Co., Cleveland, Ohio  
New England Screw Co., Keene, N. H.  
The Charles Parker Co., Meriden, Conn.  
Parker-Kalon Corp., New York, N. Y.  
Pawtucket Screw Co., Pawtucket, R. I.

Pheoli Manufacturing Co., Chicago, Ill.  
Russell, Burdall & Ward Bolt & Nut Co., Port Chester, N. Y.  
Scovill Manufacturing Co., Waterbury, Conn.  
Shakeproof Lock Washer Co., Chicago, Ill.  
The Southington Hardware Mfg. Co., Southington, Conn.  
Whitney Screw Corp., Nashua, N. H.

## Liberty Aircraft Buys Control of Autocar Co.

Reported to represent 66 per cent of the outstanding stock of Autocar Co., Ardmore, Pa., holdings of the Phoenix Securities Corp. amounting to 121,097 shares will be purchased by the Liberty Aircraft Products Corp., Farmingdale, L. I., manufacturer of precision aircraft parts, according to arrangements just completed by the Liberty and Phoenix companies. The deal is said to provide for the immediate sale of 21,097 shares and an option in force until September 15 to the Liberty Aircraft for the remaining

100,000 shares. Autocar is now making military vehicles in addition to heavy-duty commercial trucks.

## Graduation Exercises at General Motors Institute

General Motors Institute had a graduating class of 406 members for the annual commencement exercises August 22 in Flint. The class included 138 members of the four-year plant co-operative course, 163 in the two-year plant co-operative course, 27 in the two-year dealer co-operative course and 78 in the one-year dealer course.



*A pair of*

# ACCURATE HANDS!

**P**UTTING end loops on tiny springs is an exacting, careful operation. It demands nimble fingers, steady and sure of every move they make. These hands must be capable hands. Here at Accurate, there are hundreds of them busy building the springs, wireforms and stampings you need . . . the way you need them . . . when you need them. They're working hard for you—you can depend on it.

### SPRING HANDBOOK

Full of valuable data.  
Write for your free copy today!



**ACCURATE SPRING MFG. CO. 3811 W. Lake Street, Chicago**

## Business in Brief

*Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES*

General business activity continues at or near recent peak levels. The index of *The Journal of Commerce*, without adjustment for seasonal variation, for the week ended Aug. 9 stands at 123.4 per cent of the 1927-29 average, two fractional points below the figure for the preceding week, as against 105.4 a year ago. The seasonally adjusted index of *The New York Times* for the same period declined to 131.0 per cent of the estimated normal from 132.1 for the week before.

Department store sales during the week ended Aug. 9, according to the Federal Reserve compilation, rose to a level 46 per cent above the corresponding total last year, as against a similar gain of 27 per cent recorded a week earlier.

Contracts awarded for heavy construction during the week ended Aug. 14, according to *Engineering News-Record*, totaled \$91,586,000, about 61 per cent less than the figure for the preceding week but twice the corresponding amount last year.

The movement of railway freight during the week ended Aug. 9 continued a moderate recession. Loadings totaled 878,549 cars, 0.5 per cent fewer than in the week before but 20.8 per cent above the comparable number last year.

Electric power production in the week ended Aug. 16 rose almost to the peak level registered a fortnight earlier and was 16.6 per cent greater than the output a year ago.

The number of business failures during the week ended Aug. 14 was 230, as compared with 220 in the preceding week and 279 a year ago, according to the Dun & Bradstreet report.

Crude oil production in the week ended Aug. 16 averaged 3,953,300 barrels daily, a new peak, 41,350 barrels more than the average a week earlier and 13,300 barrels above the currently required output as computed by the Bureau of Mines.

Average daily production of bituminous coal for the week ended Aug. 9 was 1,725,000 tons, as against 1,750,000 tons in the preceding week and 1,428,000 a year ago.

Cotton mill activity in the same period declined contra-seasonally. The *New York Times* adjusted index was 174.5 per cent of the estimated normal, as compared with 181.6 a week earlier and 118.1 a year ago.

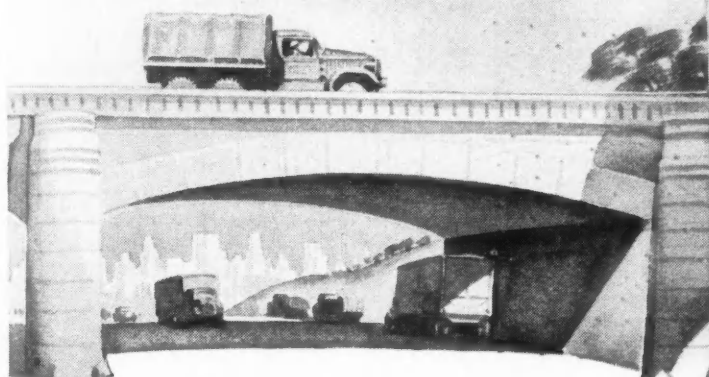
Professor Fisher's index of wholesale commodity prices, registering a new peak, stands for the week ended Aug. 15 at 96.7 per cent of the 1926 average, as against 96.2 for the week before and 81.1 a year earlier.

Member bank reserve balances declined \$3 millions during the week ended Aug. 13, and estimated excess reserves rose \$10 millions to a total of \$5030 millions. Business loans of reporting members increased \$59 millions and stood \$1685 millions above the corresponding amount last year.

## Nash Shows '42 Cars

Nash offers three lines comprising 15 models for 1942, the presentation of which was made recently to company distributors at the new-car convention in Hot Springs, Va. The three series are the Ambassador Eight, Ambassador Six and Six Hundred. Nash also has started work on \$85,000,000 worth of defense products.

# TRUCKS FOR PEACE OR DEFENSE NEED PARKER PROCESSES



**W**HETHER mobile equipment is hauling merchandise to market, or men and munitions to a defense assignment, it is exposed to the threat of rust, and should have the same measure of protection.

Millions of trucks now on the road are protected by Parker Processes. Fenders, hoods, bodies and other sheet metal parts have added finish durability and protection from rust by Bonderizing.

Parkerizing provides both a finish and rust-proofing for hundreds of small parts on every unit, while Parco-Lubrizing assures better wearing qualities for moving parts.

In many cases, Parker Processes are providing a way around shortages in strategic metals. They are serving as substitutes for conventional materials—in some instances to the distinct advantage of the manufacturer, and a betterment of the unit to which they are applied.



**Send for Literature:** Books, fully describing Bonderizing, Parkerizing and Parco-Lubrizing are available to executives and technical men. Send for copies.

**PARKER RUST PROOF COMPANY**  
2178 E. Milwaukee Ave. • Detroit, Michigan

September 1, 1941

When writing to advertisers please mention *Automotive Industries*



## PARKER *Processes* CONQUER RUST

BONDERIZING • PARKERIZING • PARCO LUBRIZING



## Harrison to Build "Cold" Test Tunnel

The Harrison Radiator Division of General Motors has begun construction of a \$100,000 automobile and aviation refrigerated test tunnel near its engineering department at Lockport, N. Y.

"We now have two car tunnels to check road conditions and summer driving and two aviation tunnels," Works Manager Douglas B. Whitney explains. "Changing conditions in the industry have brought about the need for 'cold' tunnels."

The building will be two stories high,

with a refrigerated wind tunnel for testing radiators and automobile accessories on the first floor and aviation tunnels on the second floor to test oil coolers and other airplane parts under zero and sub-zero conditions.

## Machine Tool Shipments \$5,100,000 Less in July

Machine tool shipments for July reported by the National Machine Tool Builders' Association were \$57,900,000 as compared to \$63,000,000 for June and \$60,800,000 for May. Shipments for July a year ago were \$31,500,000.

## CENSORED

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, M. W. Bourdon.

By arrangement with the Ministry of Supply, a 4-5-ton model is to be added to the range of Austin trucks, hitherto comprising only 2-ton and 3-ton chassis. The output is to be restricted and deliveries will be allocated by the Minister of War Transport only to operators giving proof of essential need in national service. It is equipped with a six-cylinder overhead valve engine (210 cu. in.) of the same size as that of the smaller models. The chassis specification includes Lockheed brakes with vacuum servo, four-speed transmission and spiral bevel drive.

\* \* \*

Additional to the Morris and Hillman Tens and the Austin Eight and Ten, a limited number of 10-hp. Ford cars will now be produced by permission of the Ministry of Supply, for sale in the home market under permit from the Ministry of War Transport. Prices will start at £193 for the two-door model, plus purchase tax, making the total about £250-£260. In 1939 this model sold at £145.

\* \* \*

For the first time in its history a loss is reported by the United Dominions Trust, one of the leading companies financing time payments in the automobile and allied industries. Time payment transactions in respect of automobiles have practically ceased since the outbreak of war, largely owing to the very small number of new vehicles available in relation to the demand, which also is greatly reduced in comparison with pre-war days.

\* \* \*

By a new Order in Council, wider control of war production companies taken over by the Government is authorized. Directors or other officials held to be guilty of an "obstructionist attitude" towards the authorized controller may be removed and replaced, and prohibited from holding any office or position in the company. And if thought fit, the Government may acquire all the shares of any such company at a fair price and arrange for their transfer.

\* \* \*

Used car prices are tending to fall slightly from the high levels they attained two or three months back, owing to the stricter rationing of gasoline and the prospect of more new cars becoming available to those people who can secure a purchase permit, which means they must produce proof of essential need in the national interest.



Diagram: Piston Ring Forming Machine.

**Problem:** Inadequate lubrication and varying coefficient of friction ( $F_c$ ) in Guide A and on Forming Head D resulted in unequal ring lengths due to jerky feed through Rolls RR.

**Solution:** "We have found that with ordinary lubrication irregular slippage occurs in the feed rolls, but with the use of "Oildag" this slippage is practically eliminated and gap accuracy can be maintained", says a prominent piston ring manufacturer.

Other tough problems such as the lubrication of forging dies, bearings operating at high temperatures, etc. can be solved by your oil supplier with lubricants containing "dag" colloidal graphite. Write for Bulletin 130 T

ACHESON COLLOIDS CORPORATION  
PORT HURON MICHIGAN



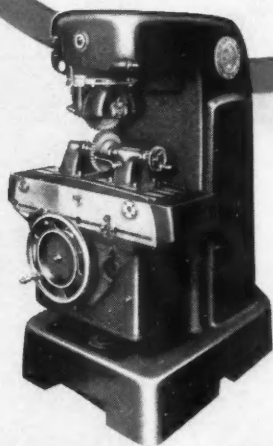
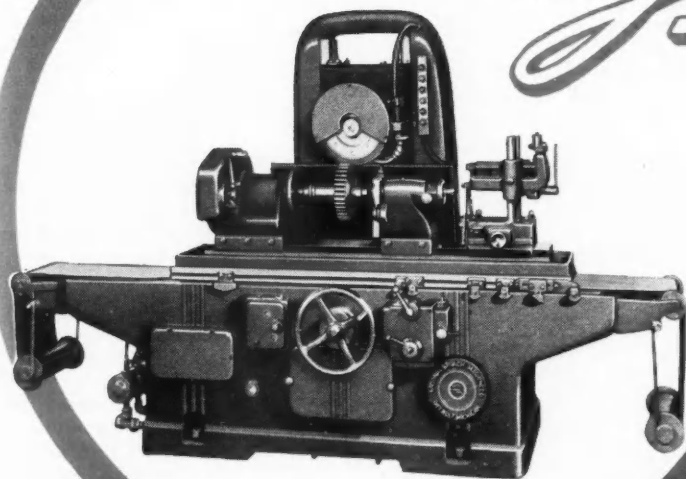
"Oildag" and "dag" are registered trade-marks of the Acheson Colloids Corporation

**IF YOU**

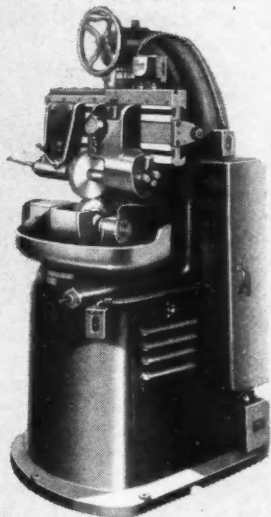
*Grind*

**GEARS**

**HERE IS THE WAY TO  
*Save*  
BOTH TIME AND  
COST**



**RED RING GEAR FINISHING  
MACHINE**



**RED RING GEAR LAPPING  
MACHINE**

In hobbing the gear, leave enough stock (.005" to .016") to take care of hobbing errors and fire distortion. Shave the green gear on a Red Ring Finishing Machine to eliminate hobbing errors and then harden.

After hardening, use a Red Ring Gear Grinding Machine to reduce the overall error to less than .001", but without sparking the wheel out. Sparking out accounts for at least half the time required by the grinding operation. It is entirely unnecessary when final finishing is done on a Red Ring Lapping Machine.

Lapping removes the fuzz left on the tooth surface by the grinding wheel, leaves tooth surfaces smooth and corrects all remaining errors to whatever degree of accuracy is desired.

This is not only faster and more economical than relying exclusively on the grinder, but it also reduces the percentage of scrap and assures greater durability and longer gear life.

*Write for bulletins on Red Ring  
shaving, grinding and lapping.*

**NATIONAL BROACH  
AND MACHINE CO.**

**5600 ST. JEAN • DETROIT, MICHIGAN**

## Detroit Exhibit

(Continued from page 42)

cooled engines, which are being built by Wright and Continental. A new airplane landing gear strut also is being developed by Chrysler in conjunction with its participation in the bomber airframe program.

Nash-Kelvinator Corp. has taken over the old shipping building of Reo Motors Inc., at Lansing for conversion into a \$12,000,000 plant for the manufacture of Pratt & Whitney aircraft engine parts. This is the second Reo plant to be taken over for operation

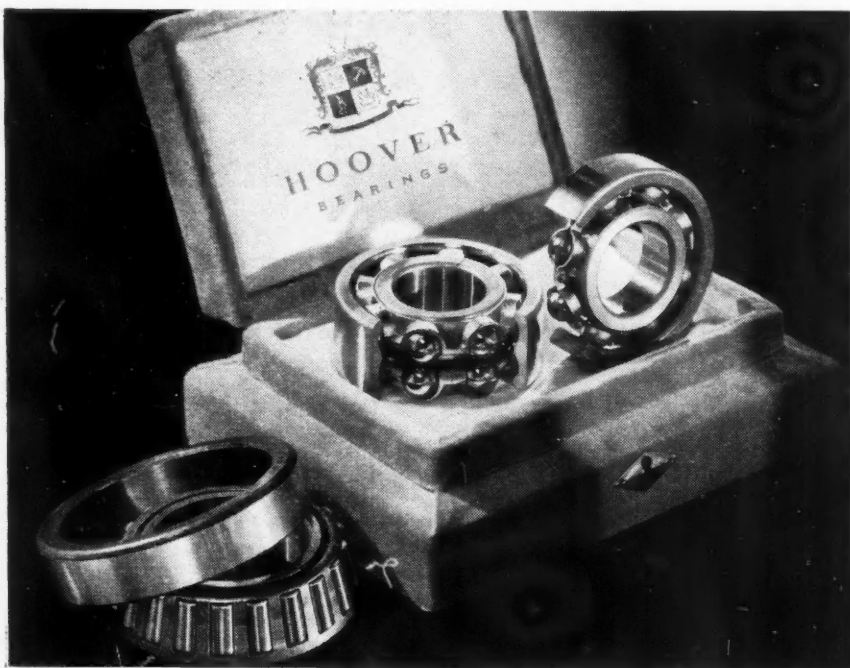
by Nash, as 400,000 sq. ft. of floor space in other Reo factory buildings is now being converted for the manufacture of Hamilton Standard propellers.

Indian Motorcycle Co. has received a \$2,050,000 order for 5000 special light army motorcycles for Great Britain. These will be 30.5 cu. in. military solo machines, with deliveries to start in September and be completed by February. Harley-Davidson Motor Co. also has an order for \$591,915 for motorcycles.

Chrysler Corp. has received another order for \$1,143,850 for half-ton Dodge

trucks and ambulances. As of June 30, Chrysler had delivered 61,211 trucks for use by the defense forces.

Other recent national defense orders include \$929,575 to International Harvester Co. for trucks and parts; \$989,452 to Chevrolet for sedans and trucks, \$585,000 to White Motor Co. for six-ton trucks \$377,597 to Biederman Motors Co., Cincinnati, for truck tractors, \$287,548 to Trailer Co. of America for trailers and semitrailers, \$2,450,000 to Guide Lamp Division of GM for cartridge cases, \$134,088 to Highway Trailer Co. for semitrailers, \$290,533 to Eaton Mfg. Co. for additional facilities for the manufacture of aircraft parts, and \$610,000 to Gabriel Corp. for shell bodies.



## Known by the Company They Keep



Hoover has concentrated on one supreme ideal—to build bearings so fine they will deserve to be associated with the big names in American industry. The fact that 400 leading firms in the automotive, machine tool, electrical and industrial fields have selected Hoover Bearings as original equipment is evidence that the phrase "The Aristocrat of Bearings" is more than a slogan . . . it is a distinction that has been earned.

# HOOVER *The Aristocrat of Bearings*

WITH HONED RACEWAYS . . . AN  
EXCLUSIVE HOOVER FEATURE

HOOVER BALL & BEARING CO., ANN ARBOR, MICHIGAN, U. S. A.

## Half-Tracs, Blitz Buggies In Anti-Tank Battalion

A new provisional general headquarters tank destroyer battalion, equipped with light and heavy anti-tank guns on self-propelled mounts, has been formed by the Army and will make its first tactical experiments in the large-scale maneuvers to be held this fall.

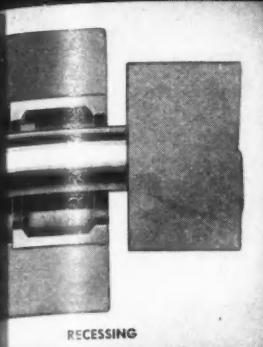
Primarily an offensive unit, the provisional tank destroyer battalion is a hard-hitting organization that may quickly engage a tank unit. With its guns mounted on half-tracs, blitz buggies and "swamp buggies," a new type vehicle, the battalion can rush into position and begin firing without wasting time to emplace its guns. Then, if necessary, it can move off to a new and stronger position without the loss of time incident to limbering when weapons are towed. Or it can press forward offensively, pursuing an enemy, also without taking time out for these functions.

The new unit, which will have a reconnaissance battery of light tanks, will have more fire power and mobility and should be able to go into action more speedily than the provisional anti-tank battalions that were formed recently.

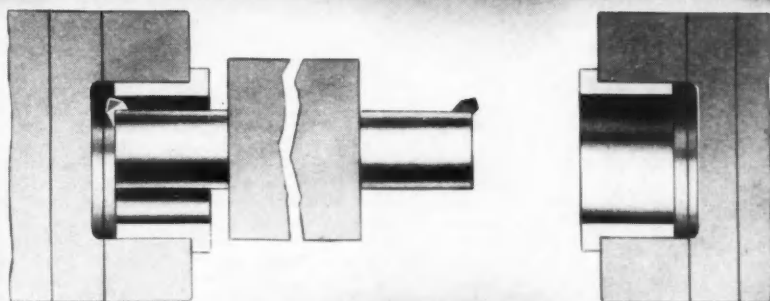
Now in an experimental stage, the new tank destroyer battalion embodies new combinations of available equipment and ordnance material that is on hand or in production. Improvements have been made in certain of the equipment in order to specially adapt it for the unit's mission. The battalion is a forerunner of many more units intended for the same purpose. The final type organization that will be adopted, however, will have even more powerful weapons and equipment of new design. Plans have already been started toward this objective.

Although the strength and armament have not yet been definitely determined, the battalion will include anti-tank guns of 37 and 75 millimeter calibers on self-propelled mounts and anti-aircraft guns for protection against low flying aircraft.





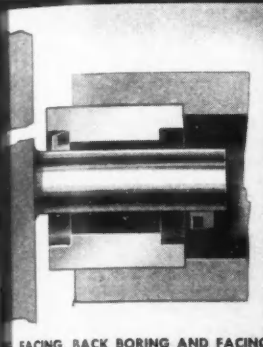
RECESSING



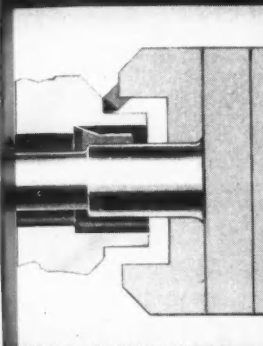
BORING • DOUBLE END SET-UP • LOADING



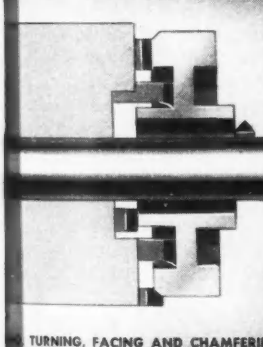
TAPER BORING



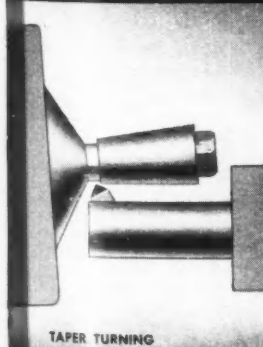
FACING, BACK BORING AND FACING



BORING, TURNING AND FACING



TURNING, FACING AND CHAMFERING



TAPER TURNING

# DESIGNED FOR MANY JOBS!

**Ex-Cell-O Standard Boring Machines Perform Numerous Operations . . . Simultaneously**



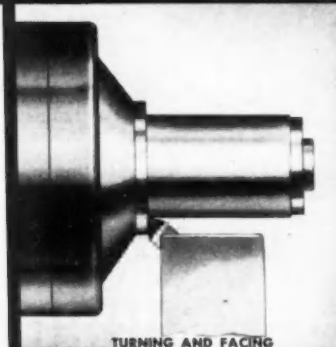
Illustrated here is a combined operation on an Ex-Cell-O Precision Boring Machine (Style 1212-A—Junior Double End) with an Ex-Cell-O Universal Fixture. Job is boring, facing, turning and chamfering brass aircraft gyro part with extremely close tolerances and on a production basis. Inspection has been minimized and other costs substantially reduced.

**I**N MACHINING interchangeable parts, there are varied possibilities to an Ex-Cell-O Precision Boring Machine. Not only will it rough and finish bore holes—straight, taper, blind, interrupted—but it will also turn, face, chamfer, groove, with almost any combination accomplished at the one time. Some of these single and combined operations are indicated by the surrounding sketches. And every Ex-Cell-O Boring Machine is a Precision Machine, with exclusive Ex-Cell-O features of design and construction that assure the greatest production of uniform work to the closest possible limits in size and finish. These Ex-Cell-O Precision Boring Machines (there are five standard styles) are enabling many manufacturers to meet successfully the unparalleled demand for defense items.

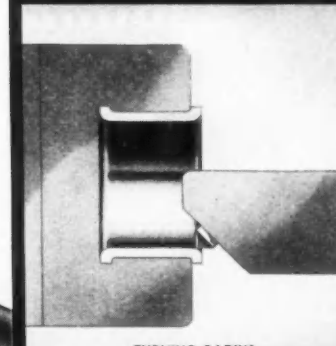
EX-CELL-O CORPORATION • DETROIT, MICH.

**EX-CELL-O**  
Precision

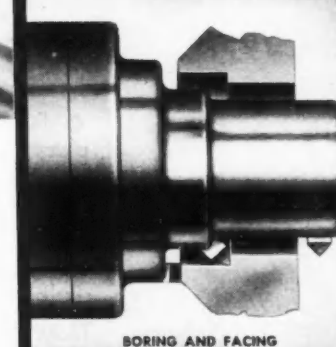
**MACHINES  
AND TOOLS**



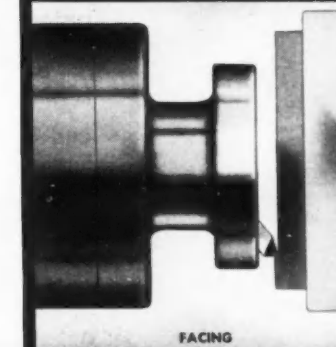
TURNING AND FACING



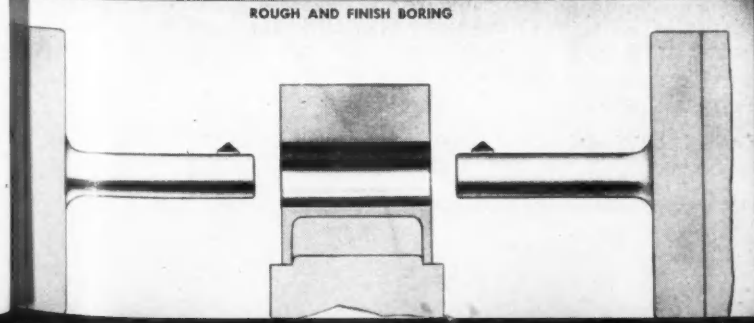
TURNING RADIUS



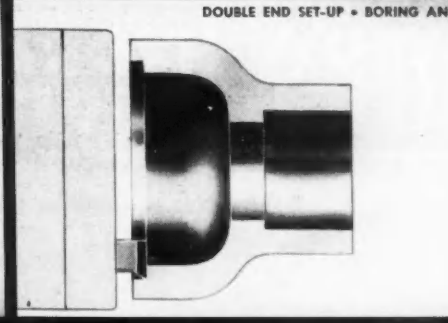
BORING AND FACING



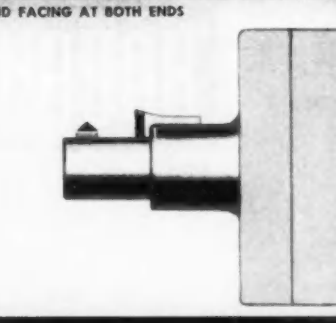
FACING



ROUGH AND FINISH BORING



DOUBLE END SET-UP • BORING AND FACING AT BOTH ENDS



## PUBLICATIONS

An 8-page brochure describing the various **flexible shaft machines** available for defense industries has been issued by Walker-Turner Co., Inc.\*

**Chip Formation, Friction and Finish** is the title of a booklet by Hans Ernst and M. Eugene Merchant, of the Research Department, Cincinnati Milling Machine Co.\*

A new **Thermocouple Data Book and Catalog** issued by Wheelco Instruments Co. contains temperature conversion tables, millivolt tables, pipe and wire sizes, etc. Prices and descriptions are given on its complete line of thermocouples and thermocouple accessories.\*

The **Technique of Felt Making**, a bulletin issued by The Booth Felt Co., includes bearing diagrams featuring felt seals and specifications covering felt.\*

Two bulletins by Ampco Metal, Inc., are **Ampco Metal in Machine Tools**, describing the use of Ampco metal by the machine tool industry and **Ampco Metal in Dies**, tells of the various grades of Ampco metal used in forming and drawing dies. Catalog No. 22 describes Ampco Metal, an alloy of the aluminum bronze class. It is illustrated and contains tables of physical properties and metal grades.\*

Globe Hoist Co.'s new catalog describes models in **hydraulic hoists** for automobile, bus and truck service work and gives new mechanical features in the design of these lifts. It is illustrated and has drawings, diagrams and complete specifications for all Hoist models.\*

A new pocket catalog, No. 1066, by The Buda Co., contains complete factual data

on all types and sizes of **jacks**, together with a table of jacks designed to help select the correct jack for any specific job.\*

Bulletin No. 1635 describing the **Gorton Model M-E Munitions Engraver**, has been published by the George Gorton Machine Co. Machine specifications, samples of work with production times, accessories, assembly and lubrication charts and an actual size work chart which permits prospective purchasers to determine whether a job will fit the machine, are included.\*

B. F. Goodrich Co. has published a new 12-page catalog section on its **Vibro-Insulators**, devices of metal and rubber designed to combat the vibration and noise problem.\*

Barber-Colman Company's Data Sheet No. 19 describes **B-C Hobbing Service** and Data Sheet No. 20 tells of the versatility of the **Type T Hobbing Machine**.\*

A new folder by National Broach and Machine Co. describes **Red Wing Automatic Precision Profiling**.\*

C. F. Pease Co.'s new catalog, M-41, presents a concise description of its line of **Blueprinting Machines and Accessories**.\*

"**Power for Industrial Plants**" is the title of an 8-page booklet by Caterpillar Tractor Co. The booklet is illustrated and contains descriptions of power installations.\*

Bulletin No. 12, **Handy & Harman**, describes the low temperature silver brazing alloys, **Sil-Fos and Easy-Flo**.\*

The September issue of **Oxy-Acetylene Tips**, publication of the Linde Air Products Co., contains an article on **bronze-welding damaged automobile cylinder blocks without preheat**.\*

\* Obtainable through editorial department, **Automotive Industries**. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

## Steel Orders

(Continued from page 44)

traction of supplies handled by scrap iron dealers and brokers, but the flow of scrap from producers direct to mills has so quickened in the last few months that there is no indication of steel mills having to curtail operations because of lack of this raw material.

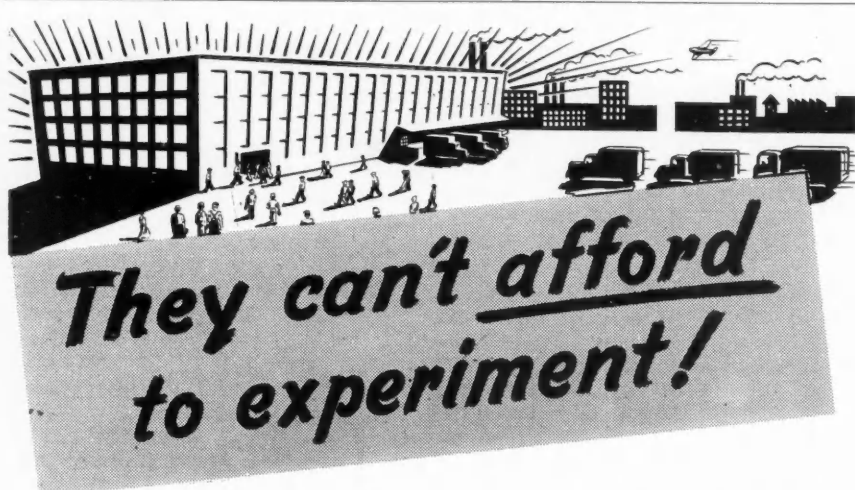
With a 52 cents per pound maximum price established for tin, the market for this metal is now on that basis. In spite of the ceiling set here, the Singapore market has recently scored several notable advances, but it still is sufficiently below New York parity to make imports from the Straits Settlements possible. In some quarters it is thought that Russian buying was the prop for the price rise in the East. Goodsized cargoes of Bolivian tin concentrates have been arriving in anticipation of the opening of the new smelter at Texas City, where initial operations are scheduled early in 1942.

## Dr. Frederick Eichberg

Dr. Frederick Eichberg, 65, a consulting research engineer for the Stinson Division of Vultee Aircraft, Inc., died July 30 at Ann Arbor, Mich. At one time he was manager of the Junkers plant in Germany.

## Tire Casings Up

Replacement sales of automobile casings to consumers during the second quarter of 1941 numbered 13,078,000, a high record for recent years and 20 per cent above the 10,900,000 for the second quarter of 1940, when business was also above normal.



## Here is an aircraft builder's experience with hydraulic oils

● Back in pre-war days one of America's leading aircraft plants used a hydraulic oil which served on the average of one year of 8-hour days before change was necessary.

As shifts multiplied and machine production was stepped up, shop men noted danger signals in machine tool hydraulic systems: foaming and discoloration which revealed acidity and sludging.

They changed to Houghton's Hydraulic Oil . . . and have obtained 24-hour service for more than a year, with clean systems and freedom from foaming. That's three times the service obtained from the former oil.

And that's why they say, when asked to try a "cheaper" oil: "We can't afford to experiment! What we want is production, and Houghton's Hydraulic Oils can be depended on for their important phase of trouble-free operation."

If you're not entirely satisfied with the hydraulic oil you're using, why not try Houghton on the very next change? Write for folder, sample and full data.

**E. F. HOUGHTON & CO.**

Chicago

PHILADELPHIA

Detroit

# HOUGHTON'S HYDRAULIC OILS

# Are You Machining Heat-treated Alloy Steel...300 to 400 Brinell?

CONSIDERABLE heat treated material is machined with standard cutters, taps, etc., but as is the case in most specific applications, specially designed tools operate more satisfactorily and usually more than offset the additional expense involved in their purchase. We recommend that the following details be incorporated on various cutting tools in use on the hard materials.

On cutters the relief should be reduced to approximately one-half the normal standard relief. Standard rake is often satisfactory but best results usually are obtained by the use of rake best suited to the work. Helical flutes usually produce better results because of the greater side-shearing action. Coarse teeth, slow speeds and heavy feeds tend to keep cutting edges working with less tendency to glaze over the cutting surface.

Taps should have positive rake with straight faces, and preferably full eccentric relief and narrow lands to reduce friction. Taper taps should have reduced relief to provide additional strength to the cutting edges and also to shear chips off closely on reversal.

Reamers should be of the blue helix type with right hand cut and right hand spiral. A secondary chamfer usually will produce exceptionally fine finish in reamed holes.

Saws should have staggered teeth and side chip clearance. Reduced relief is necessary on this type of tool.

Turning tools should have reduced clearance angles for greater strength. Top and side rakes of  $8^{\circ}$  to  $10^{\circ}$  are quite satisfactory.

Sulphur base cutting oils are generally more satisfactory than the soluble or emulsified types of oils. Due to the extreme tenacity of the chip in heat-treated materials, much heat is generated and a large volume of oil should be used.

Our engineers will be glad to help you get the best production on these tough jobs. Write to PRATT & WHITNEY, Division Niles-Bement-Pond Co., West Hartford, Connecticut.



These are heat-treated alloy steel parts for an adjustable pitch airplane propeller . . . and they are tough jobs to machine. A—dome retaining nut and the "diamond blue" hob that cut the thread. B—stationary cam "impossible to get production without specially designed cutter." C—counterweight bracket "40 holes reamed . . . production increased 2 to 4 times." These three parts are between 300 and 415 Brinell! P&W designed, made and heat treated the tools that licked them.

## PRATT & WHITNEY

ONE OF A SERIES TO MAKE PRATT & WHITNEY RESEARCH AVAILABLE TO AMERICAN SHOPS





## German Half-Track

German mechanized equipment includes half-tracks of this type which are used both for troop carriers and hauling anti-tank guns. These units are said to be used extensively in the Russian campaign.

## AMA Yearbook Presents Industry's Contribution

The economic importance of the automobile industry to the nation for both defense and civilian needs is statistically presented in the 1941 issue of *Automobile Facts and Figures*, the annual handbook of the Automobile Manufacturers Association.

Three out of every four trips made by car is a necessity trip, while more than half the mileage rolled up on passenger cars is for necessity purposes. By economic groups, commercial travellers pile up the highest annual business mileage on their cars and physicians make the most necessity trips. Classified by age, the oldest cars have the highest percentage of necessity use.

Factory sales in the United States in 1940 totaled 3,692,328 passenger cars and 777,026 motor trucks, the yearbook shows. More than 80 per cent of new vehicle sales were absorbed in replacing old vehicles scrapped. Over the past 10 years a yearly average of 2,908,144 new vehicles have been sold at retail, while 2,338,661 old vehicles have been scrapped.

Registrations on farms and in towns under 2500 population account for 40 per cent of motor vehicle registrations, the statistics reveal. Automobiles are owned on 76 per cent of the farms in the United States, where three-fourths of their trips are for necessity uses. More than 2300 cities in the United States are without a local mass transportation system and depend on private passenger cars.

Of the 6,700,000 persons employed in motor transport, 1,310,724 gain their livelihood from the sales and servicing end of the business, it is disclosed. On the manufacturing side, including workers in the parts, tires and petroleum refining companies, some 679,000 workers held jobs. Motor truck drivers account for 3,739,200 jobs.

Of the defense jobs underway, aircraft work leads the list, with more than a billion dollars worth of contracts being assigned to the motor industry. One of the industry's big jobs, too, is the production of military vehicles. Deliveries up to July 31 of this year totaled 187,000 military vehicles.

# Felt

**THE MATERIAL OF  
MANY AUTOMOTIVE USES**

Whether your business requires felt products made and cut to standard or "special" specifications, Western Felt Works is equipped to give you prompt service on these quality felts:

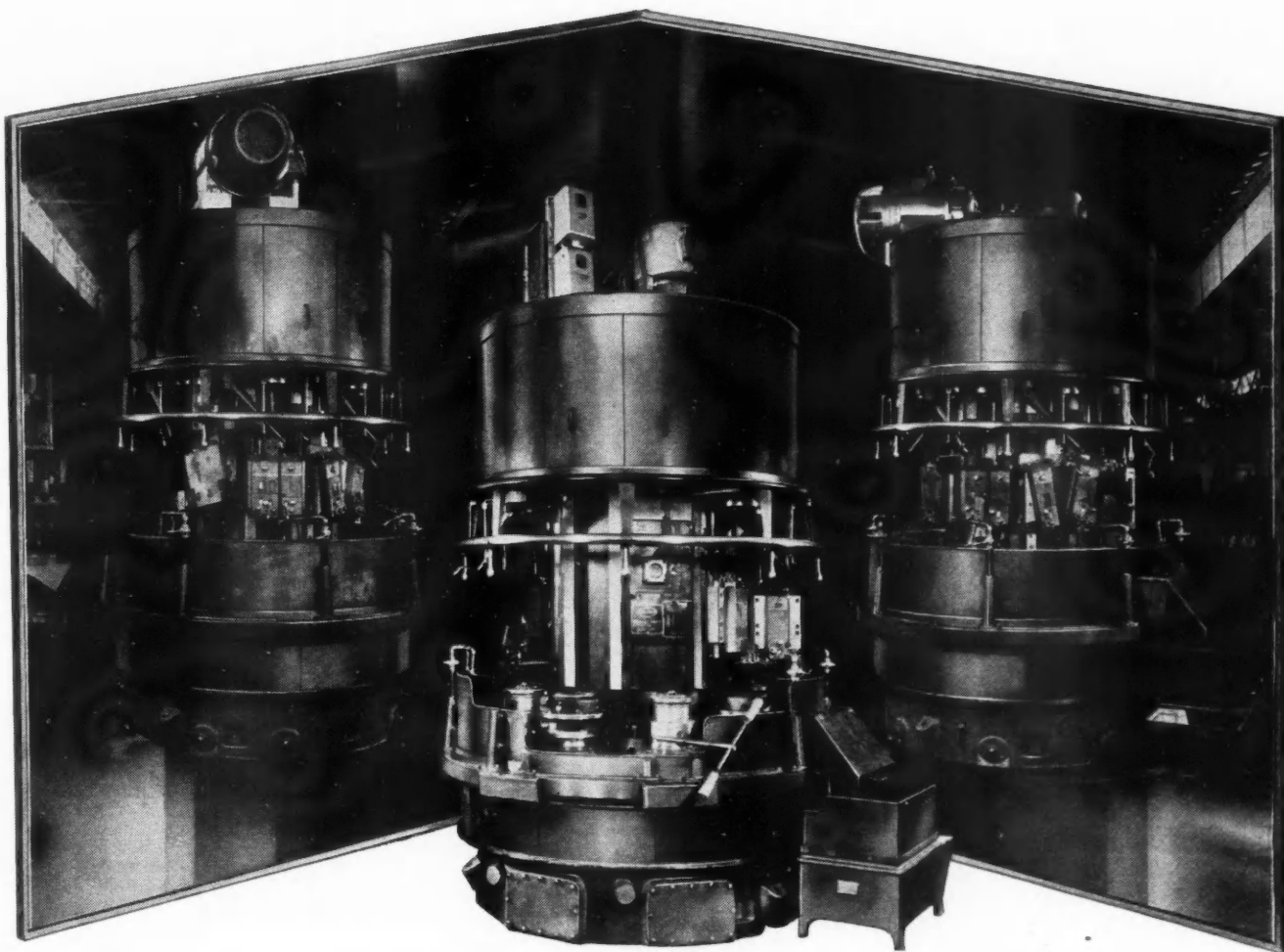
Pads Channels	Floor-Board Anti-squeak Strips Body to Frame Anti-squeak Strips Weatherstrips Packing Lubrication Wicks Sheet Felt for Polishing and Rubbing Jute Floor Pads Jute Felt Insulation	Washers Gaskets Gaskofelt Gaskets Resistofelt
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Furnished in Rolls or Cut to Size  
Estimates Gladly Furnished  
Write Today for Quotations

**WESTERN  
FELT WORKS**

4035-4117 Ogden Avenue      Chicago, Illinois

Largest Independent Manufacturers and Cutters of Wool,  
Hair and Jute Felts. Established 1899.  
Also Acadia Molded Synthetic Rubber Products  
BRANCH OFFICES IN ALL PRINCIPAL CITIES



## WHAT IS THE MULT-AU-MATIC METHOD?

It is the division of the total machine work on any given part into numerous separate operations in such a way that all the work can be done simultaneously and in the time of the longest single operation.

## WHAT IS A MULT-AU-MATIC?

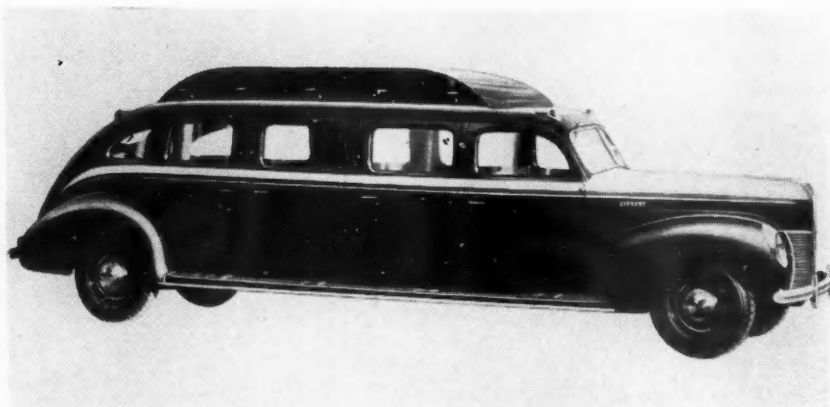
It is a machine with 6 or 8 working spindles, each completely independent as regards speeds, feeds, and tooling; so arranged that machining operations are carried on simultaneously on each spindle, with the exception of the one reserved for loading and unloading.

TOOLING CHANGE-OVER FROM PREVIOUS JOBS TO DEFENSE JOBS WHERE NECESSARY HAS BEEN DONE QUICKLY AND EASILY. IT WILL BE EQUALLY EASY LATER TO SHIFT THEM BACK TO PEACE TIME ACTIVITIES. A MULT-AU-MATIC IS ALWAYS A GOOD INVESTMENT.

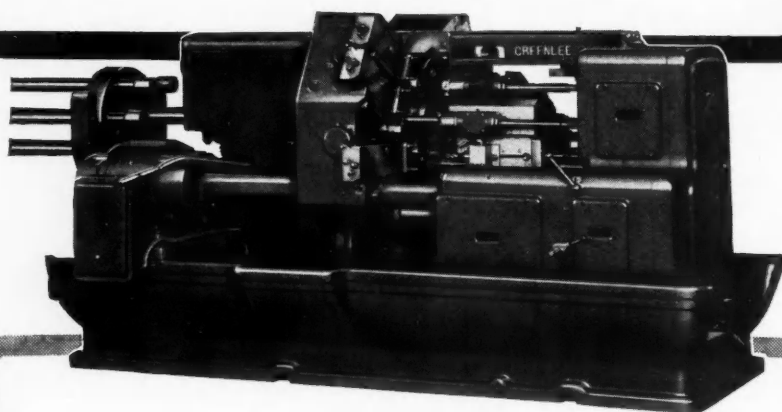
**THE BULLARD COMPANY**  
**BRIDGEPORT, CONNECTICUT**

## Siebert Sedan Bus

Manufacturer of special vehicles since 1853 when it built "Prairie Schooners" for the gold rush of those days, the Shop of Siebert, Toledo, now makes special automotive units such as buses, hearses and ambulances using standard Ford cars, which are lengthened 3 or 6 ft. as required. The work is done by sawing the frame and body apart, then inserting steel extensions and arc welding the structure back together again by the shielded arc process with equipment manufactured by Lincoln Electric Co. This vehicle, a 11-passenger sedan bus, was ordered by a concern in South Africa.



## THERE'S NO SHORT CUT TO SPEED...



Here in the Greenlee Bros. & Co. plant, our big job today is to turn out Automatic Screw Machines just as fast as we can . . . but it's also part of our job to see that every Greenlee Machine is built right to insure maximum speed and dependable accuracy day after day.

We're working fast, but not too fast, to make sure that every Greenlee Automatic turned off the assembly floor is built not only to meet today's urgent demand for speed, but also to give you years of continued service after this emergency has passed . . . machines built with the same skilled craftsmanship, the same high grade materials, the same strict standards of inspection and the same precise accuracy that went into every Greenlee Automatic produced before this emergency.

**GREENLEE BROS. & CO. ROCKFORD ILLINOIS**

## BOOKS . . . .

**FRAZER & JONES' MOTOR VEHICLES AND THEIR ENGINES, Fifth Edition** by Norman G. Shidle and Thomas A. Bissell, with the assistance of Tench Francis. D. Van Nostrand Co., Inc., New York.

This well-known work on the elements of automobile mechanism, which was originally prepared for the instruction of Army truck drivers during the World War, has now been issued in a fifth edition, for which it was prepared by Norman Shidle and Thomas Bissell of the SAE Journal staff. The last previous edition appeared in 1930, since which time many new features have been introduced in automobile design, and these are at least briefly referred to without notable omission, though the treatment is necessarily brief, as all parts of the motor vehicle engine and chassis, their maintenance and repair, together with the subject of motor fuels, are covered in 330 pages. The book is intended to give a clear knowledge of the theory of operation and maintenance of modern automobiles to students approaching the subject for the first time. All descriptions apply to passenger-car parts, but as practically the same principles are embodied in the design of motor trucks, especially those of moderate load capacities, a study of the book will be helpful to prospective truck operators and maintenance men as well.

**TRAINING WORKERS AND SUPERVISORS**, by Charles Reittel. Published by the Ronald Press Company, New York.

Since the demand for skilled labor is growing rapidly with the development of the defense program, the training of labor in the different skills and of supervisors for such labor is of timely importance, and a book dealing with this subject therefore should meet a demand. Mr. Reittel, who already has to his credit a work on a related subject, entitled "How to be a good Foreman," in the present volume seeks to be of help to the numerous concerns confronted with the problem of rapidly expanding their working force and their supervising staff. The book is divided into four sections. In Part I are discussed modern methods of selecting employees. Part II, which deals with training methods, lays emphasis on correct habits in the performance of operations and on good teaching. Part III discusses training methods in detail—methods calculated to ensure both quantity and quality of output. In Part IV the underlying factors in good relationships between management and labor are discussed. A bibliography of the field covered by the book is included.

**ENGINEERING DRAWING**, by D. E. Hobart, assistant professor of mechanism and engineering drawing, University of Michigan. Published by D. C. Heath & Co., New York, N. Y.

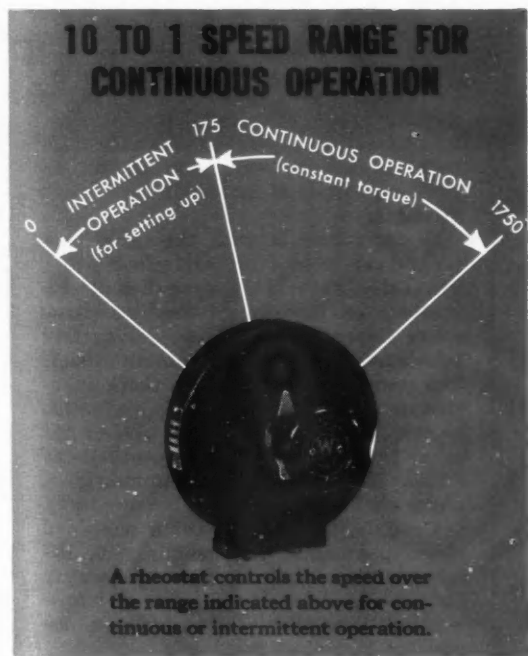
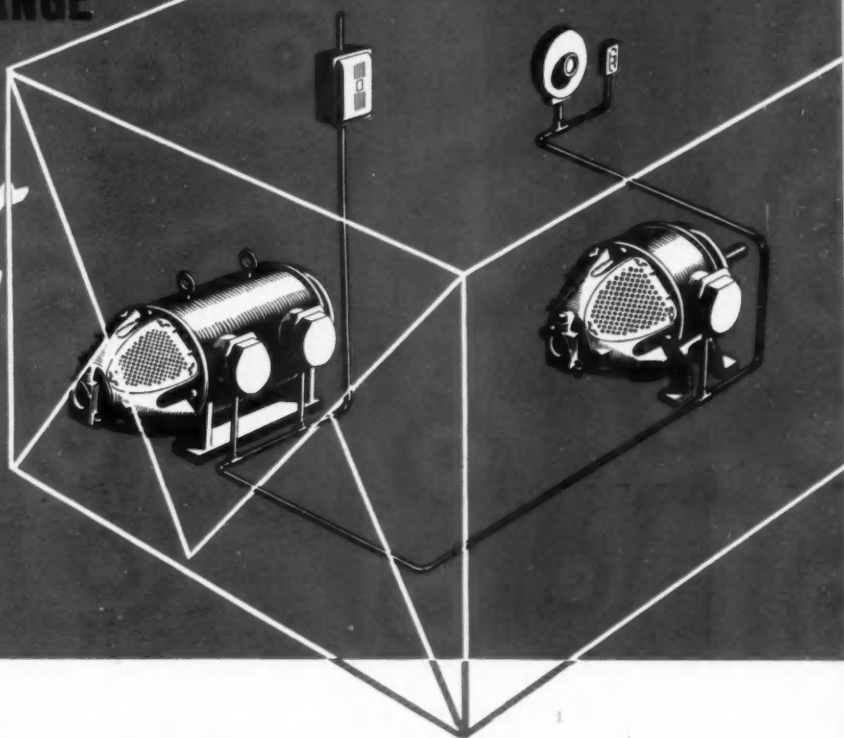
(Turn to page 62, please)



# NEW WESTINGHOUSE DRIVE

**PROVIDES 10 TO 1 SPEED RANGE  
FROM A-C POWER**

*at low cost*



## OPTIONAL FEATURES OF NEW A-C DRIVE

Optional features include reversing dynamic braking in the off position and inching. Dynamic braking requires no external brake resistors. A braking field is wound into the motor.

When dynamic braking is used, inching control is provided by the addition of a momentary-contact push button. This feature is especially valuable where strip material must be fed slowly at the start.

Here's an adjustable speed, constant torque drive that lets you meet a wide range of speed requirements with a-c power. For continuous operation you can select any speed from 175 rpm to 1750 rpm, and, regardless of load variations or temperature changes, speed will be maintained within close limits. Where slower speeds are required for starting or setup, speeds below 175 rpm can be obtained.

## EASY TO OPERATE

No complicated adjustments are necessary. To obtain the speed desired, the operator simply sets the rheostat and pushes a single starting button. No exciter, no exciter rheostat, no clutch, no complicated control is required. All units of this drive are standard equipment.

## EASY TO INSTALL

A squirrel-cage motor, mounted in the same frame with a d-c series generator, is installed in the most convenient location and connected to a magnetic linestarter. A series d-c motor is then connected to the driven machine and a low resistance rheostat and push button mounted on the machine. A small conduit between the units completes the installation.

There's nothing else to buy. With this complete power package you can quickly solve your adjustable speed drive problem at low cost. Order today through your nearest Westinghouse office.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY  
EAST PITTSBURGH, PA.

## GET THIS NEW FOLDER

Write today for folder DD-4063. It gives complete details about the new Westinghouse adjustable speed a-c drive.



J-94468



# Westinghouse

MOTORS AND CONTROL

## BOOKS

(Continued from page 60)

This book is intended as a text for classes in engineering drawing, but it should be equally useful for self-instruction. It has a rather wide scope, for it deals not only with what is generally described as mechanical drawing, but also with isometric drawings, developments and intersections, free-hand sketches, charts for graphic representation and computation, map drawing, and construction drawing. The first chapter is devoted to the selection and use of equipment, the second to lettering, and then follow chapters on Applications of Geometry, Orthographic Projection, Sectional Views, Dimensioning, Fastenings, Springs and Piping; Working Drawings, etc. The book is written in clear

language and copiously illustrated, and it should serve its purpose well.

## Car Output Cut For Next Three Months 31 Per Cent

With approximately 90,000 passenger cars turned out in August, production for the next three months will be limited to 726,801 cars, in accordance with the OPM-OPACS order, which amounts to a curtailment of approximately 31 per cent as compared with the same period last year. For the four months including August, the cut averages 26½ per cent, and progressively more was forecast in following months to

effect a 50 per cent reduction for the model year ending July 31, 1942.

Passenger car production quotas, as established by the two government agencies are given in the first column of the following table:

Company	Four Months Ending November 30, 1941	Four Months Ended November 30, 1940
	1941	1940
General Motors	361,815	511,700
Chrysler	188,849	275,600
Ford	151,845	182,800
Total for large companies	702,509	970,100
Studebaker	35,289	46,160
Hudson	25,874	41,900
Nash*	21,972	20,942
Packard	23,056	25,710
Willys-Overland	7,768	8,364
Crosley	333	185
Total for smaller companies	114,292	143,261
Total for all com- panies	816,801	1,113,361

\* The increase shown for Nash over the corresponding period of 1940 resulted from the fact that Nash had an unusually low output during the four-month period last year.

At the same time the Priorities Division of OPM announced it is preparing a blanket preference rating order to aid truck manufacturers in obtaining scarce materials quickly. The order extends a preference rating of A-3, the same rating granted previously for freight cars, to deliveries of critical materials required for heavy motor trucks, medium motor trucks, truck trailers, public passenger buses, and replacement parts for trucks of 1½ tons and over, and buses of similar types.

On the day following the curtailment announcement, 600 automobile manufacturers, parts makers and jobbers met with OPM officials who urged them to convert their manufacturing facilities to defense work due to the decreasing supply of materials for civilian products.

Directly tied in with the OPM passenger car production curtailment program are Federal Reserve Board regulations on installment credit to take effect September 1, except for certain provisions relative to administration. The regulations designed to check inflation and to conserve defense materials, permit an 18-month credit period for all of the listed 24 durable goods' items listed. On new and used automobiles, along with aircraft and other products, the regulations provide for a one-third down payment. Automobiles, as defined in the regulations, are passenger cars designed for the purpose of transporting less than 10 passengers, including taxicabs.

The maximum credit value of a new automobile is fixed at 66 2/3 per cent of the bona fide cash purchase price of the automobiles and accessories, including any sales tax and any bona fide delivery charges.

## Change Name

Lyon Iron Works, Greene, N. Y., manufacturer of material handling equipment, has changed its name to Lyon-Raymond Corp. The company continues under the same management.

## CUT THOSE PRODUCTION KNOTS

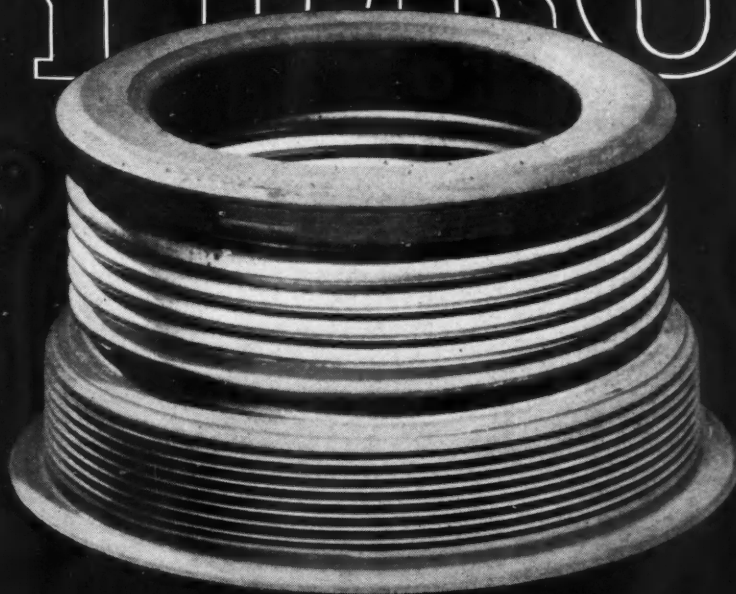


**I**F metal cutting seems to tie things up in your plant—put a Wells Band Saw to work. It will handle 1001 jobs in the stockroom, production line, or on maintenance work—because it's *fast, versatile, accurate and portable*. You can get a Wells quickly, and the cost is low. Check into the details today.

Visit us at the Metal Show in October  
 Booth E-54

**WELLS MFG. CORP.** Three Rivers  
 Michigan

# HYDRON



*H*

YDRON bellows shaft seals perform valuable service today in fluid-drive couplings. These entirely metallic seals are assembled with hard solder, and therefore can withstand without deterioration of any kind, any temperatures which the fluid couplings themselves are capable of withstanding.

The all-metallic HYDRON shaft seal not only prevents any leakage of the vital coupling oil but also, and of equal importance, it prevents breathing, that is, the intake of air as the coupling cools after operation. In short, the HYDRON shaft seal is complete insurance against either liquid or gaseous leakage.

The service record in the automotive field up to date indicates trouble-free operation under all conditions.

## CLIFFORD MANUFACTURING CO.

PRODUCERS OF HYDRON HYDRAULICALLY-FORMED METALLIC BELLOWS  
FOR ALL TYPES OF TEMPERATURE AND PRESSURE CONTROLS.

564 EAST FIRST STREET, BOSTON

CHICAGO: 221 North LaSalle Street

LOS ANGELES: 1503 West 8th Avenue

DETROIT: 6432 Cass Avenue

September 1, 1941

When writing to advertisers please mention *Automotive Industries*

63



## 1000 Lb. Less Weight

This car with a plastic body, recently displayed by Ford, is said to weigh about 2000 lb., or 1000 lb. less than a conventional car of comparable size. The superstructure of the plastic unit consists of 14 plastic panels mounted on a tubular welded frame. The total weight of all panels is about 250 lb. and the metal frame the same amount. Composition of the plastic panels is a mixture of synthetic resin with a fibrous material derived from such crops as wheat, flax, raimi, hemp and spruce pulp. The mixture is preformed through a suction device and then molded under 1500 psi pressure. The panels are joined by a plastic cement. The Ford Co. has a light engine under development to match the reduced weight of the car. Lowell E. Berly, design engineer of the car, is seated at the wheel.



International

# GOOD ON THE DRAW

# with KERN'S

## DRAWING COMPOUND



We are eager to demonstrate a Kerns Drawing Compound on your toughest job. Write or phone for a test sample. There is no obligation.

### DEFENSE

against the outlaw on the old frontier called for a man who was mighty good on the draw.

Times have changed. Defense against today's outlaws has become a factory job. The call today is for industrial plants that are mighty good on the draw.

Kerns drawing compounds are speeding defense on job after job by

- 1-SPEEDING PRODUCTION
- 2-REDUCING BREAKAGE
- 3-ELIMINATING

SCRATCHING

- 4-PREVENTING DISCOLORATION
- 5-FACILITATING CLEANING
- 6-INCREASING DIE LIFE

Kerns guarantees to reduce your drawing compound costs.

## The L. R. KERNS CO., Inc.

Manufacturers of Industrial Lubricants  
2842 East 95th Street • Chicago, Ill.  
TELEPHONE: SAGINAW 6656

## 72 Per Cent of World Motor Vehicles in U. S.

Motor vehicles registered throughout the world as of January 1 of this year totaled 45,376,891 units, of which 32,452,861, or 71.7 per cent, were in continental United States, according to the Department of Commerce.

A breakdown by types of motor vehicles included in the Department's reports records the registration of 36,343,260 passenger cars; 444,028 busses; 8,400,025 trucks; and 189,578 Diesel units.

American makes of motor vehicles, including those produced in Canadian branches of American factories, accounted for about 83 per cent of the total world registrations, it was said.

Countries having the largest number of motor vehicles registered, other than the United States, at the beginning of the year included the United Kingdom, 2,429,580; France, 2,398,500; Canada, 1,477,282; Union of Soviet Socialist Republics, 1,060,000; Australia, 858,905; Italy 498,500; Union of South Africa, 393,698; Germany, 327,000; and Argentina, 309,500.

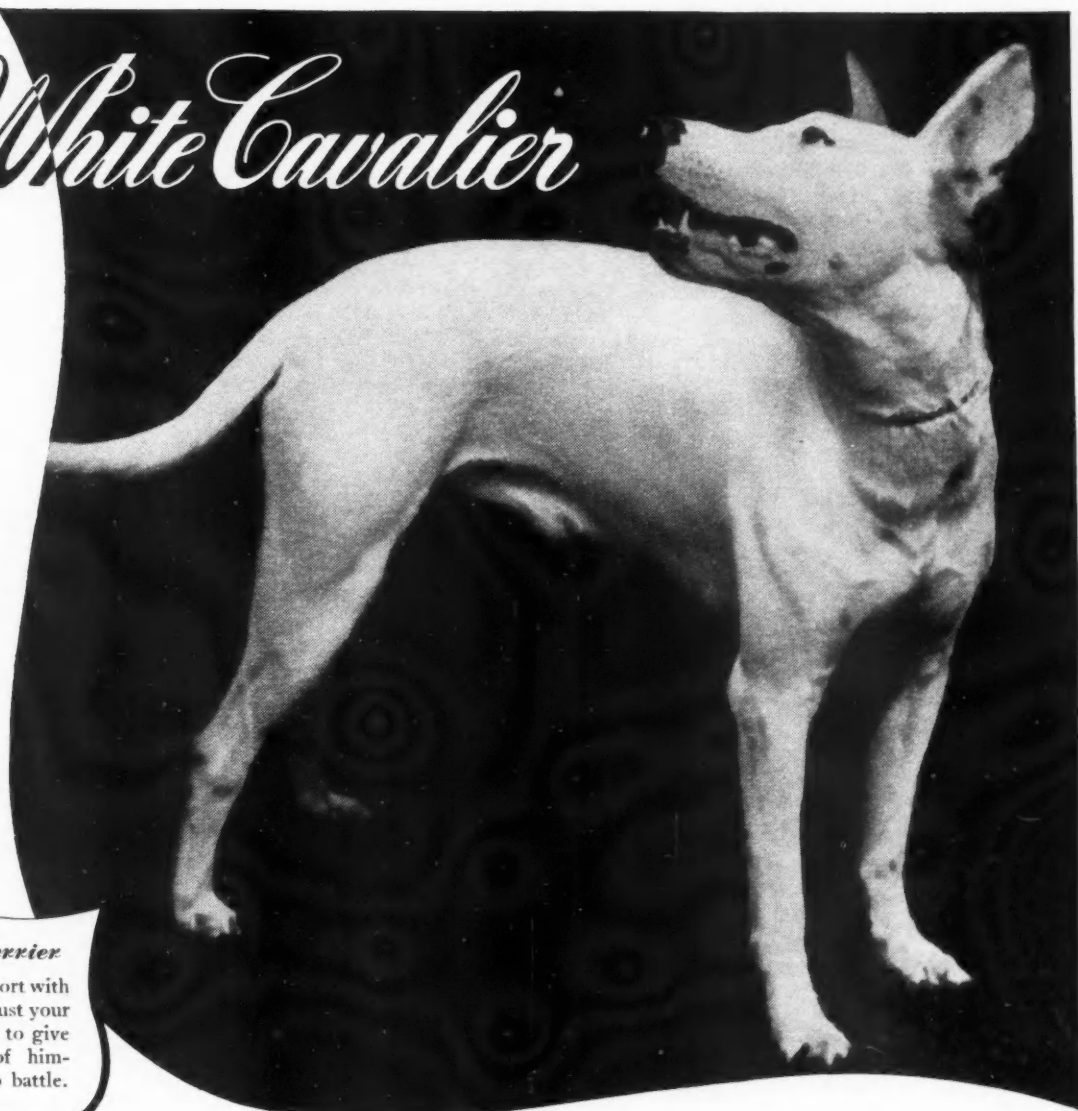
The ratio of motor vehicles to population in some of the more densely motorized countries outside of the United States shows New Zealand with 1 motor vehicle to every 6 persons; Canada, 1 to 8; France and Gibraltar, 1 to 17; United Kingdom, 1 to 19; and Denmark, 1 to 23.

In contrast, the Department reported, registrations in Muscat, on the south shore of the Gulf of Oman, are at the rate of 1 motor vehicle to every 27,788 persons; Liberia, 1 to 6,818; and China, 1 to 5,939.

## Government Needs Industrial Specialists

In its search for specialists in all branches of industry and business, the U. S. Civil Service Commission has announced that the industrial specialist examination will remain open for receipt of applications until further notice. Industrial specialists are needed by the Government in the metals, machine tool, ordnance, aircraft, marine, automobile and other fields. Salaries range from \$2,600 to \$5,600 in the various grades.

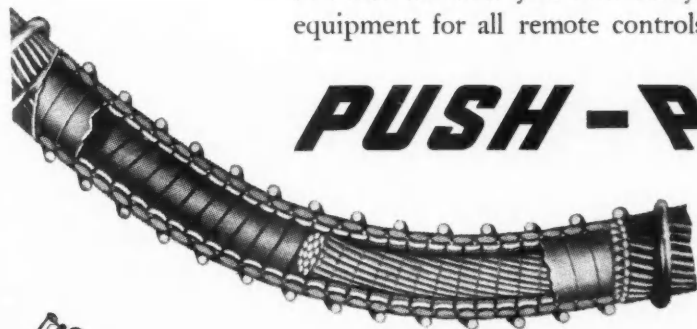
# THE *White Cavalier*



## *The Bull Terrier*

A brave, gallant escort with whom you can entrust your very life. Well able to give a good account of himself when called to battle.

To know "*The White Cavalier*" is to love him for his courage, gallant spirit and willingness to go into action upon command . . . There's a lot of the Terrier about PUSH-PULL AUTOMOTIVE CONTROLS, too. You see it in their instant, direct action. They serve your equipment in this efficient way year after year because the control operates in a bath of lubricant so sealed that lubricant can not escape nor can grit or moisture enter. They operate quietly—end rattles associated with other controls . . . Let us show you how easily PUSH-PULL CONTROLS can be applied to your equipment for all remote controls—most likely without change in engineering.



## **PUSH - PULL**

### **AUTOMOTIVE CONTROLS**



AMERICAN CABLE DIVISION • 6-235 General Motors Bldg., Detroit, Mich. • 630 Third St., San Francisco, Cal.

**AMERICAN CHAIN & CABLE COMPANY, Inc.**

## Hudson for '42

(Continued from page 31)

All Hudsons have the new concealed running boards. At night a courtesy light, operated by doors, gives full illumination to the running boards.

Offered as a low-cost optional extra on all models, the Hudson Drive-Master is a new development in driving simplicity. Clutch operation is entirely eliminated, except as a safety precaution when starting the motor, and gears shift automatically and silently, yet under complete control of the driver.

The clutch is operated by one power cylinder utilizing engine vacuum, the gears shifted by another. Shifting is actuated by a mechanical governor and controls. Included is a new second gear especially designed for acceleration.

For 1942, Hudson has 11 new body colors as standard on all models. These include Gunmetal, Pageant Green, Nomad Tan, Quartz Gray, Hickory Tan, Brigade Blue, Spring Green, Jackson Blue, Maroon, Republic Gray and

Black. Two additional colors, Copper Russet and Royal Red, are available at extra cost on all models.

Four two-tone exterior color combinations are standard in Commodore Custom models and available at low cost on all other models. Two-tone combinations available include Nomad Tan Opalescent with Hickory Tan Opalescent, Quartz Gray Opalescent with Republic Gray Opalescent, Pageant Green Opalescent with Spring Green Opalescent and Brigade Blue Opalescent with Republic Gray Opalescent.

Many new conveniences are noted in all Hudsons. A new headlight beam indicator appears on the instrument panel. Ignition lock has an illuminated key well. Front seats are adjustable through a 4-in. range. Tops of all convertible models, except in the lowest price Hudson line, raise or lower automatically at the touch of a button on the instrument panel.

### Apparatus for Cleaning Glass Viscosimeters

A cleaning and drying apparatus for glass viscosimeters used in determining kinematic viscosity has been placed on the market by C. J. Tagliabue Mfg. Co., Brooklyn, N. Y.

The tubes are placed over and supported by vertically extended metal capillary pipes, through which the cleaning fluid is sprayed into the tubes. Drying is accomplished by passing air under pressure through the tubes. Pressure is regulated by means of special valves.

The equipment also is adaptable in connection with the cleaning of other types of glassware such as test tubes and pipettes.

### Farm Products Vital to Building Motor Cars

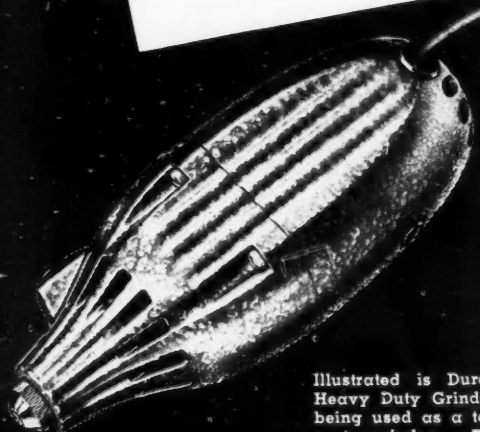
How farm products figure in the building of passenger cars and trucks is itemized by the Ford Motor Co., which estimates that for every 1,000,000 units manufactured by the company, the following amounts of agricultural products are required:

Cotton—69,300,000 lb. or the annual output of 433,125 acres; wool—3,204,000 lb. or the wool from approximately 801,000 sheep; wood—112,000,000 board feet or 20,500 acres of forestlands; cattle—30,000 head to provide 1,500,000 sq. ft. of leather; soybeans—600,000 bushels; flax—118,000 bushels equivalent to 17,500 acres; tung oil—195,000 gallons; hogs—20,000 head to provide 1,000,000 lb. of lard oil lubricant; corn—451,500 bushels, equivalent to 11,280 acres; wheat—120,000 lb. as flour used in foundry; goats—87,500 head to provide 350,000 lb. of mohair material; jute—5,000,000 lb.; pine pitch—2,060,000 lb.; sugar cane—enough to provide 2,500,000 gal. of molasses; honey bees—83,000,000 bees to produce 6000 pounds of beeswax; castor oil—150,000 gal.

## Use DURO GRINDERS

For speed and accuracy in grinding, drilling, routing, cutting, filing, polishing, carving, cleaning operations on intricate tools, dies, patterns, moulds, etc. Thousands of manufacturers have found Duro Heavy Duty Grinders time and money savers. Their high speed of over 24,000 R.P.M. enables fast and accurate cutting. Their surplus power of over 70 watts output gives them unusual performance. Their streamline design fits the hand. You can use them in restricted and hard-to-get-at places on machinery without removing the part. They're portable—can be used wherever there's a light socket to plug into. A big assortment of cutting and polishing accessories available. Duro Grinders top the field in value. Priced from \$9.95 to \$15.95. Ask for catalog of grinders and accessories.

**DURO METAL PRODUCTS COMPANY**  
Dept. AI-9 — 2649 N. Kildare — Chicago, Ill.



Illustrated is Duro's Heavy Duty Grinder, being used as a tool post grinder. The adaptor holds grinder. Easily adjustable to any position for internal and external grinding. Hand grinding and polishing can be easily and rapidly handled. Delicate or heavy work is all the same to this vibrationless tool. A practical grinder for the Tool Room and Die Room, or Production shop. Do more with less effort.



**DURO ★ TOOLS**  
**INCREASE PRODUCTION**



# There are THREE



## AIR-BRAKE SYSTEMS

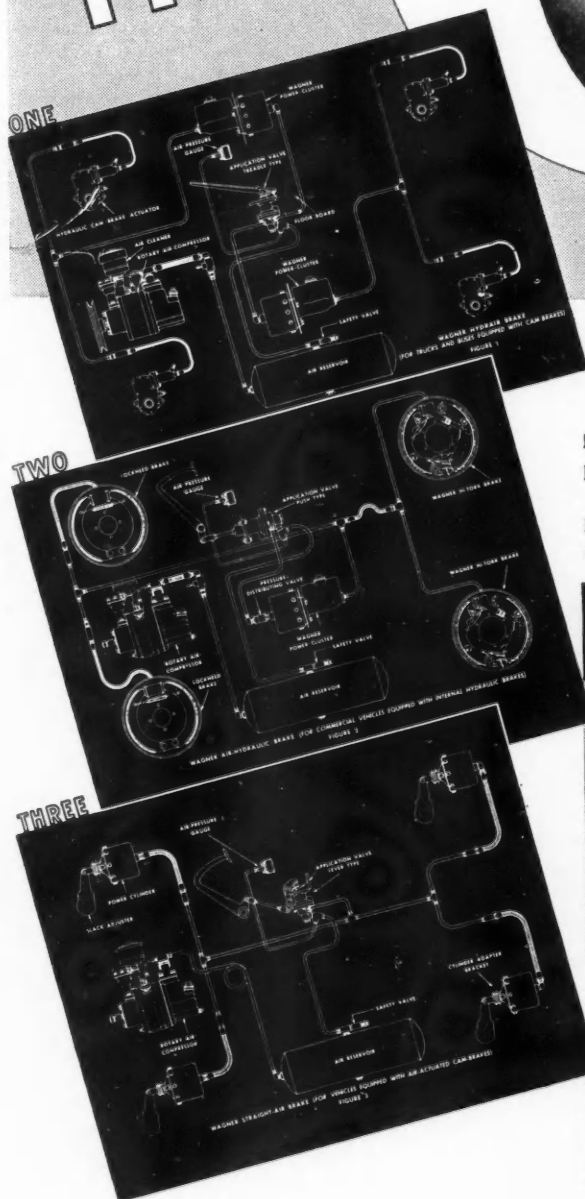
**DESIGNED TO MEET EVERY BRAKING REQUIREMENT FOR TRUCKS, TRACTORS, TRAILERS, AND BUSES.** Wagner engineers have developed three distinct air-brake systems—each one designed to meet a specific braking requirement. These three systems are shown diagrammatically at the left and are available and applicable for all types of commercial vehicles.

### EQUIP YOUR VEHICLES WITH WAGNER AIR BRAKES

Today, one of the most important considerations in the profitable operation of commercial vehicles is their cost of upkeep, and the most important item, in this respect, is the braking cost. Higher speeds, heavier loads and increased competition demand high braking efficiency if pay-load profits are to be maintained.

Successful operators have been quick to realize this, and many of the leading fleet operators and truck owners who have already equipped their rolling stock with Wagner Air Brakes are reporting decreased truck maintenance.

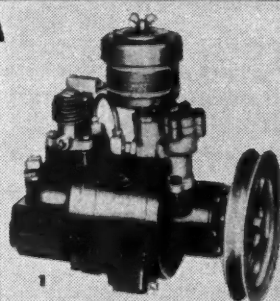
### ALL PARTS THAT MAKE UP THE WAGNER AIR-BRAKE SYSTEMS ARE RUGGEDLY BUILT AND EASY TO INSTALL



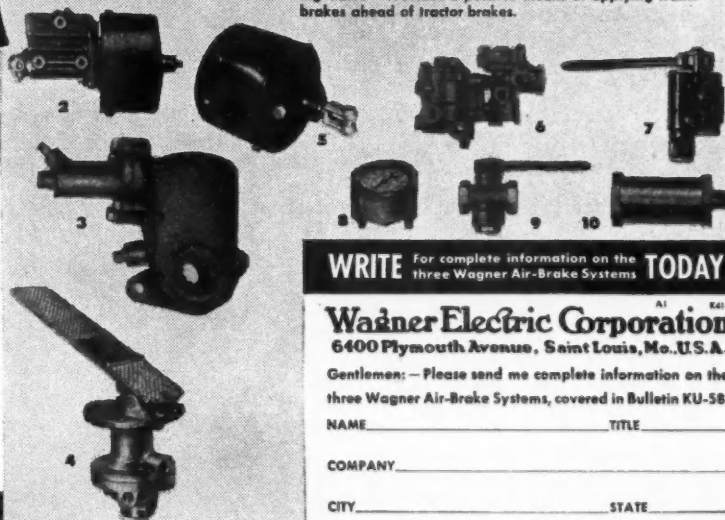
**ONE...Wagner Hydrair Brake...**The system that provides air-powered hydraulic actuation for heavy-duty vehicles equipped with cam-operated brakes. Easily installed on production-vehicles and gives the vehicles you manufacture and sell an added sales feature.

**TWO...Wagner Air-Hydraulic Brake...**The ideal system for converting vehicles equipped with manually-operated internal hydraulic brakes into REAL air-powered hydraulic brakes. Simple to install without disturbing the present hydraulic system—merely substitute air power for manual effort.

**THREE...Wagner Straight-Air Brake...**Where straight-air operation is desired, Wagner can supply a superior system to give reliable and efficient actuation for cam-brake-equipped vehicles.



1. Wagner Rotary Air-Compressor—Available only in Wagner Air-Brake Systems. 2. Wagner Power-Cluster—Simplifies the application of air power to hydraulic-brake systems. 3. Hydraulic Cam-Brake Actuator—Provides hydraulic-brake actuation for cam brakes as well as easy brake adjustment. Intended for heavy-duty vehicles and buses equipped with cam-operated brakes. 4. Application Valves—Three types available: treadle type (shown), push type, and lever type. Controls the air power applied to the particular system used. 5. Power Cylinder—Converts the energy contained in compressed air into mechanical force. 6. Relay, Quick-Release, Emergency Valve—Provides a high degree of safety and efficiency in trailer-tractor operation. Installed on trailer. 7. Hand-Control Valve—For dual valve control—applies trailer brakes only. 8. Air Gauge—Shows air-reservoir pressure. 9. Shut-off Cock—Provides a simple method of shutting off air to trailer when trailer is disconnected. 10. Pressure-Distributing Valve—Provides a positive means of applying trailer brakes ahead of tractor brakes.



**WRITE** For complete information on the **TODAY**  
three Wagner Air-Brake Systems

**Wagner Electric Corporation**  
6400 Plymouth Avenue, Saint Louis, Mo. U.S.A.

Gentlemen:—Please send me complete information on the three Wagner Air-Brake Systems, covered in Bulletin KU-58.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

# MEN and MACHINES

(Continued from page 39)

**T**YPE D, 25-in. radial crank grinder, just announced by the Landis Tool Co., Waynesboro, Pa., is intended primarily for radial crankshaft work, but with the proper tooling it is suitable for a wide variety of operations, including rough-grinding the pin diameters and adjoining radii, squaring the ends of the center section, grinding the web faces adjoining the pins of the center section, squaring the ends of the pins on both the front and rear sec-

tions, grinding the web faces adjoining the pins on both the front and rear sections, semi-finish grinding the pin and adjoining radius of both the front and rear sections, and finish-grinding the pins and adjoining radii after assembly of the shaft.

A work speed of 30 or 55 r.p.m. is available on the standard machine, which uses a 42-in. grinding wheel. Hydraulic power is utilized to traverse the work table.

A one-hp. work drive motor, a three-hp. pump drive motor and a 15 to 25-hp. wheel drive motor are recommended. Floor space required by the machine is 8 ft. 10 in. by 16 ft. Its net weight, including electrical equipment, is 22,200 lb.

Another product added to the Landis line is a high-speed hand operated  $\frac{3}{8}$ -in. threading machine, with spindle speeds of 270, 338, 520 and 845 r.p.m. (Illustrated on page 38.)

**F**OR TOOL and light snagging grinding, Hammond Machinery Builders, Inc., Kalamazoo, Mich., have introduced three "OK" model grinders equipped with a heavy duty motor-on-spindle for 10 in., 12 in., and 14 in. wheels and powered by one, two, or three hp. motors, respectively. All have a spindle speed of 1750 r.p.m.

Standard equipment includes the heavy duty motor with oversize ball bearings sealed against dust, push-button starter, exhaust-type semi-steel guards, adjustable spark deflectors, tool tray and removable water pot, and adjustable tool rests. Illustrated on page 39.)

**H**ANNA ENGINEERING WORKS, Chicago, is manufacturing a Portable Hydraulic Riveter which incorporates a flexible suspension unit to provide speed and ease of operation. It is said to be capable of driving a  $\frac{3}{8}$ -in. diameter rivet cold or a  $\frac{5}{8}$ -in. rivet hot, having a ram pressure of 17½ tons and a ram stroke of 3 in. The power unit is completely enclosed, including a 2-hp. motor for driving the high pressure pump. Standard yokes (C frames) are available in 4 in. reach and 6 in. gap, 6 in. reach and 6 in. gap, 8 in. reach and 8 in. gap, 10 in. reach and 8 in. gap, 12 in. reach and 8 in. gap. (Illustrated on page 39.)

**A** SIMPLE motor driven machine for stamping details on the base of finished shells has been placed on the market by M. E. Cunningham Co., Pittsburgh, Pa. It also can be furnished as a fixture for setting up on an ordinary lathe.

The complete motor driven machine is constructed with a rotating head similar to a lathe with drive coming direct from a specially set up motor. The shell is held securely in place by means of solid steel clamps and pressure



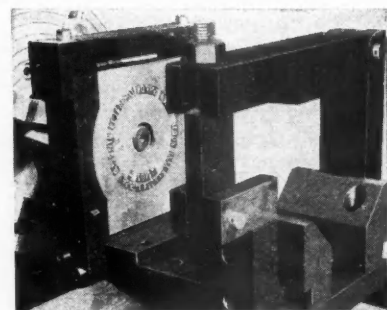
## HOLTITE-Phillips Recessed Head SCREWS & BOLTS

*are as Time-Saving and Efficient  
as a Zipper*

Assembling time reduced to 50% and more . . . spoilage and injuries eliminated! These are the highly profitable features that have made HOLTITE-Phillips screws, bolts and allied fastenings the choice of progressive manufacturers who have adopted faster driving methods to speed deliveries and cut costs. • • Regular HOLTITE products, and Specials, offer every user an unlimited range of fastenings that can be profitably used in the assembly of practically every manufactured product.

## CONTINENTAL SCREW COMPANY

New Bedford, Mass., Warehouses at Detroit and Chattanooga



Cunningham shell marking machine

**FROM BILLETS  
TO BULLETS**

*Faster..*



with **AIRCO** MACHINE GAS CUTTING

Speeding-up an important step in the manufacture of shells is one of the defense jobs assigned to this Airco Radiograph Gas Cutting Machine. 65 blanks an hour are being cut from 3½-inch thick billets of .45-.50 carbon steel. Due to the slightly rounded edges of the billets, this illustration shows a hand torch being used as a preheating medium; otherwise the notched effect between the parallel billets would lower the efficiency of the billet-cutting operation. - - - This is but one of the many ways in which Airco gas cutting machines

are helping to accelerate the defense program. Where quantities of machine gas cut parts are required — whether large or small — there's an Airco machine to do the job, quickly, accurately, economically. Visible evidence of this can be seen in hundreds of plants where Airco machines are daily speeding production on thousands of different products. A new booklet describing the No. 4 Radiograph shown above may help end your metal-cutting headaches. A request on your company letterhead will bring a copy promptly.

**Air Reduction**

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.  
DISTRICT OFFICES IN PRINCIPAL CITIES



*Anything and Everything for* **GAS WELDING or CUTTING and ARC WELDING**



to force shell against type is gained through a tail stock attachment. Each character is driven into the shell separately, thus avoiding great pressure or shock to get a deep, clear impression.

**A** NEW line of AC transformer welders in 300, 500, 750 and 1000 amp. capacities has just been announced by Wilson Welder & Metals Co., Inc., New York. Known as Model TW, these welders are completely self-contained units that will meet the heavy arc welding needs. They have a wide range of current output and continuous stepless current regulation is provided over the entire range by means of a hand crank

on top of the machine. This crank makes it possible to rapidly shift the setting as changes are made from one class of work to another.

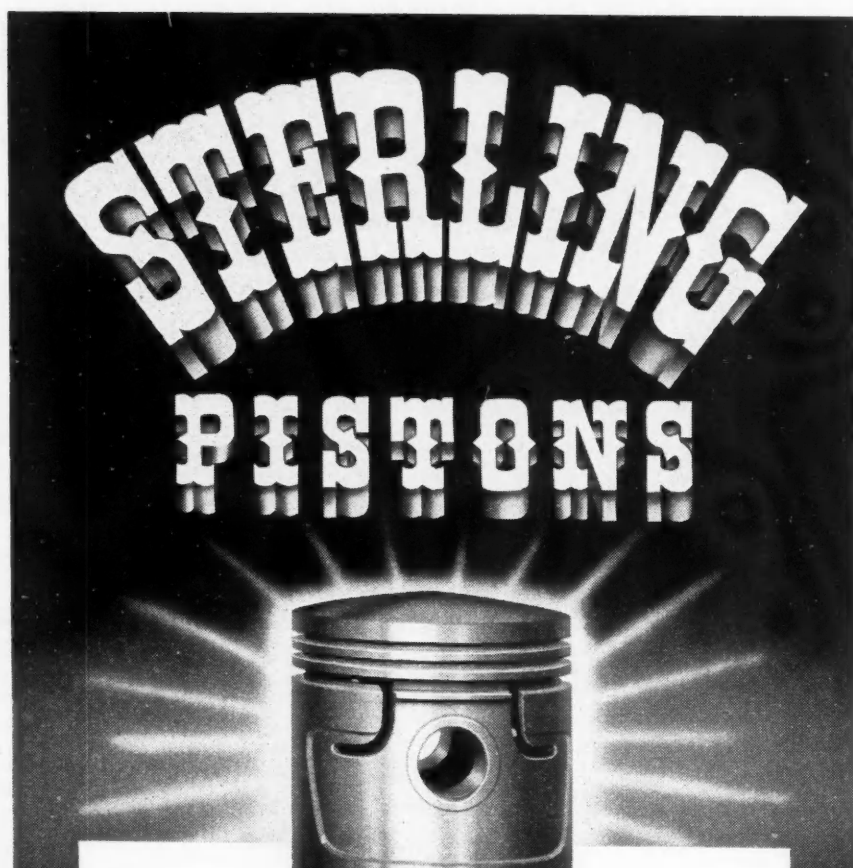
**A** NEW type of heat treating furnace construction, which incorporates a radiant tube indirect gas heated convected air system, has been developed by the Despatch Oven Co., Minneapolis, Minn., to meet the present defense needs for speedy fabrication, rapid installation, and dependable accurate performance. The new Despatch furnaces are suitable for the heat treatment of both aluminum alloy and alloy steel parts.

This new type of radiant tube convected air heating system on top of the furnace includes a heater that due to its external location eliminates the radiant heat from the interior of the furnace. A fan delivers air into the work chamber at a velocity approaching 60 to 70 m.p.h. The heated air is distributed through ducts along the sidewalls and in the bottom of the furnace.

**T**O SPEED up defense production of timing rings, dials, graduated rings and other precision adjustment parts, the Acromark Corp., Elizabeth, N. J., offers a new type of steel stamping die for use in a punch press. The die is set in a power press and the part to be stamped is centered underneath it in a fixture. The marked part can be filled with black or other color enamel to make the markings more pronounced.

**C**OMpletely conveyORIZED electric salt bath furnaces now are being made and installed in defense industries by the Ajax Electric Co., Philadelphia division of Ajax Metal Co. A 90-kw. furnace was installed recently in a Mid-West automotive plant for case hardening alloy steel parts. Larger units of this mechanized type also are made for all heat treating operations from 300 to 2400 deg., including simultaneous brazing and carburizing, tempering, hardening molybdenum high speed steel tools, annealing, brazing, and heating for forging. Technically, Ajax furnaces are said to be of the resistance type because the molten heat treating salt is itself the conductor heated by its own resistance to an electric current.

**M**ANY features to provide short cuts in print making are contained in the new Model "C" high speed automatic whiteprint machine recently an-



**UNIFORMITY — FOR SMOOTH PRODUCTION**

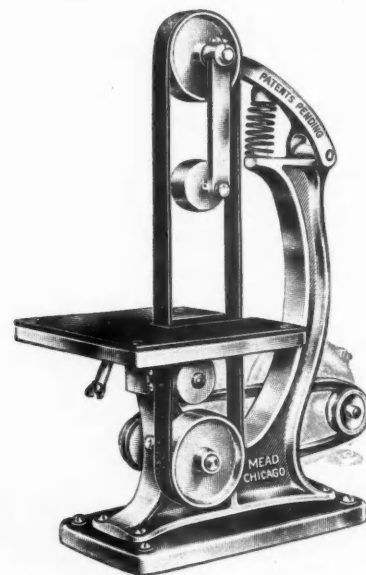
Sterling Pistons are molded under an exclusive Sterling process for exacting uniformity. Each piston casting goes through controlled heat-treatment before regulated man and machine inspection.

the result—

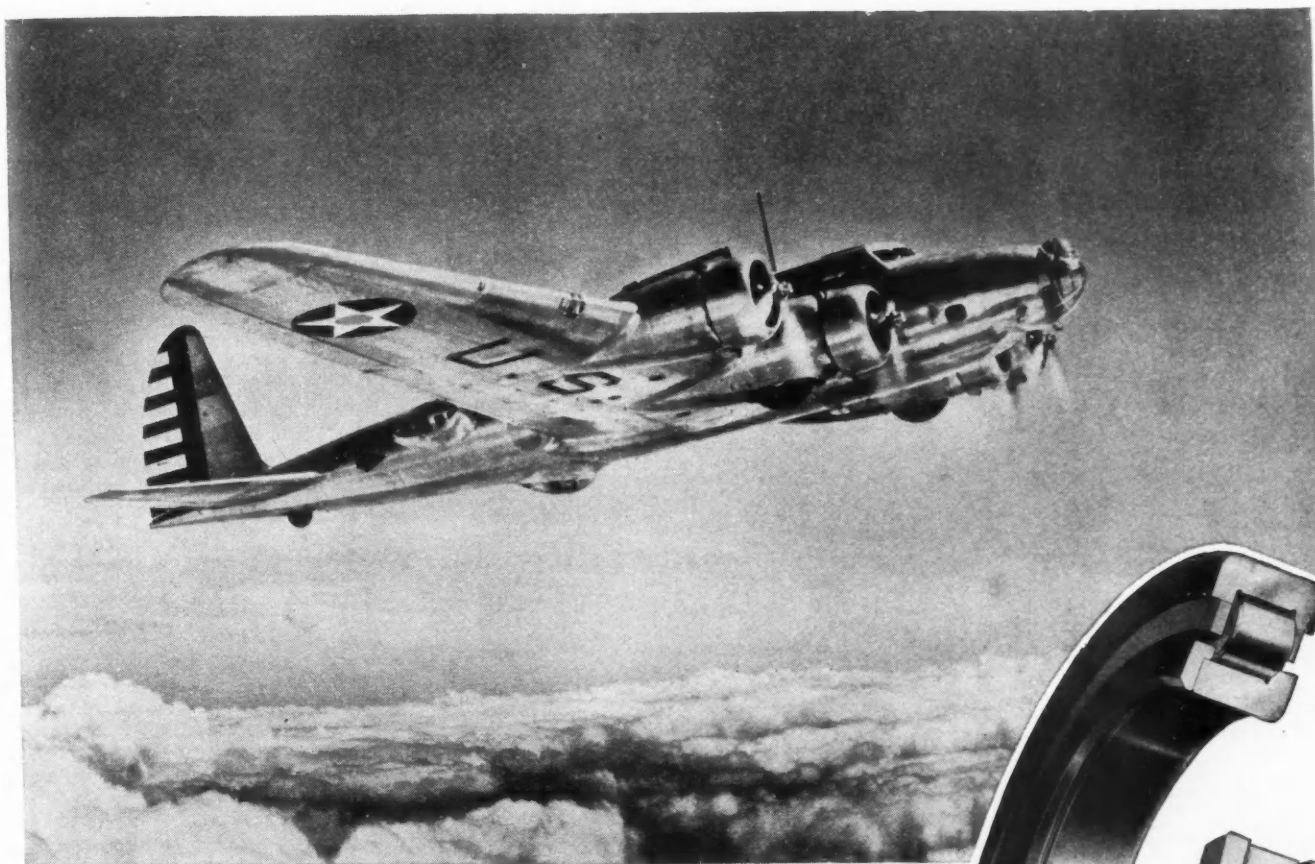
**STERLING PISTONS FOR UNIFORMITY**

**STERLING ALUMINUM PRODUCTS, INC.**

**SAINT LOUIS**



*Mead Bandsander, a handy tool for cutting, sanding and polishing wood, plastic and metal projects. It is made by Mead Specialties Co., Chicago.*



On the cranksbafts of these four Cyclone Engines, built by Wright Aeronautical Corp., are SKF Bearings that have a one-piece retainer permitting ease of disassembly and a thorough inspection of all parts.



# Flying Fortresses

## GO ALOFT ON SKF

The world's eyes are on the skies over America as giant Flying Fortresses, powered by four Wright Cyclone Engines, go aloft in steadily increasing

numbers. Every Flying Fortress—and every other ship driven by SKF-equipped engines—is a symbol of security for Democracy.

4795

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

ROLLER **SKF** BEARINGS

nounced by the Ozalid Products Division, General Aniline & Film Corp., Johnson City, N. Y. This machine is synchronized to print and develop Ozalid sensitized materials up to 42 in. wide in one continuous operation.

Correct voltage adjustment is assured by a terminal board on the transformer, which is equipped with taps permitting adjustment for line voltage from 200 to 235 volts at 5 volt intervals. The Model "C" requires 19 sq. ft. of floor space.

## Place Self-Locking Bolts

The Place self-locking bolt, a development of Place Cap Screw & Bolt Co., Jersey City, N. J., is formed with a cup-shaped depression in the head and with a recess on the under side of the head at its junction with the shank, as shown in the accompanying drawing.

No lockwasher is needed for the cap screw, which when drawn tight against a non-yielding surface, will lock securely in the threaded member to which it is assembled. Owing to the form of the head, there is greater elastic deformation than with a standard screw,

and the screw therefore offers greater resistance to unscrewing or loosening tendencies than a standard screw. This is said to be confirmed by accelerated vibration tests.

The depression in the head and the recess in the lower face are so proportioned that the shearing strength of the weakest section (x) exceeds the tensile strength of the shank at the bottom of the thread.

These self-locking bolts are said to cost no more than equivalent standard bolts and they are now being used to a certain extent in automotive engines for main-bearing caps and as piston-pin lock screws. In aircraft applications the Place bolt has the further advantage that the cupping and recessing of the head reduce the weight, the re-



## Insist On LIFELONG ACCURACY

● Thermostatic controls—small devices with big responsibilities—left without attention for long periods—doing their jobs automatically. As moving parts they wear out just as automobiles do eventually—BUT here's the key to consistent performance:

DOLE BI-METAL, the actuating force in Dole Thermostats, does not fall off gradually in efficiency. It will flex an indefinite number of times without fatigue. This means these elements CAN be left without attention for long periods to do a control job automatically, just as well the 5000th time, or 5,000,000th as the first—right up to the point where other moving parts fail. Elements of Dole Bi-Metal will, like faithful servants, work until they drop . . . and work accurately to the last.

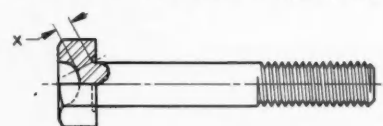
### Dole Bi-Metal Sold Separately

This special qualification recommends Dole Thermostats as motor temperature controls for your cars—or Dole Bi-Metal as raw or partly fabricated material for any thermal control devices you make. Write for engineering data or buying information on either or both.

**THE DOLE VALVE COMPANY**  
1901-1941 Carroll Avenue, Chicago, Ill.  
Offices: Detroit and Albany, N. Y.

# DOLE

## THERMOSTATS and BI-METAL



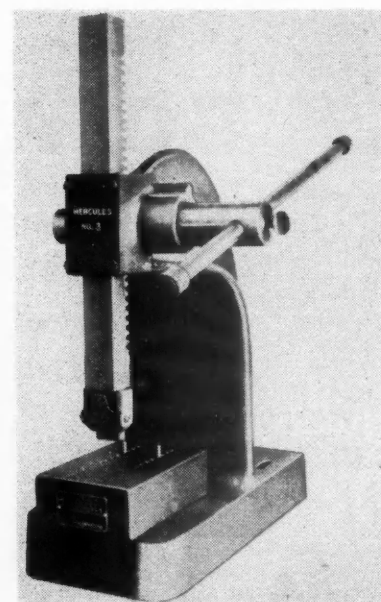
duction in weight amounting to as much as 17 per cent in some cases.

Manufacturers licensed to manufacture the Place cap screw and bolt include National Machine Products Co., Detroit; Federal Screw Works, Detroit; National Screw & Manufacturing Co., Cleveland; Chandler Screw Products Corp., Cleveland; Russell, Burdsall & Ward, Port Chester, N. Y., and Buffalo Bolt Co., Buffalo, N. Y.

## Acromark Arbor-Press Outfit

A new outfit for stamping numbers into defense parts that have to be numbered is offered by Acromark, Elizabeth, N. J. It is also handy for numbering name plates, tool checks, workmen's badges metal or fibre identification tags, gears, etc.

This outfit consists of an arbor press



Acromark Number Press



# BEARINGS FOR TRAIL BLAZERS

**TYPICAL  
BUNTING BEARINGS  
SUPPLIED FOR  
MENASCO AND OTHER  
LEADING AIRCRAFT  
ENGINES**



● "Advanced design...pioneering... improvements of an almost radical nature" characterize the new Menasco Pirate and Super Pirate inverted, in-line, air-cooled engines. Bearings supplied by Bunting for this ultra-modern power plant set new standards for precision in every detail.

Not only in aviation but wherever trail blazers in advanced mechanical design demand unprecedented qualities in bearings, engineers and manufacturers look to Bunting for the experience, facilities and resources to fill their requirements.

You are in no way obligated when you seek our collaboration in the solution of your bearing problem... The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

# BUNTING

BRONZE BUSHINGS  
PRECISION BRONZE BARS



BEARINGS  
BABBITT METALS

having a square ram to insure straight up and down movement. It is fitted with a press style Hercules-type holder for any number of pieces of interchangeable type up to the capacity of the press, which is 50 to 1.

The stamping block is cast iron, machined and finished smooth and parallel with the type face. It has guide pins that can be placed in the proper position for locating the mark on the part to be stamped.

## OPM-OPACS, Functions and Control of Industry

(Continued from page 15)

In some instances the service parts business is more important in dollar value than is the original equipment business. This much is certain—the

parts maker whose volume has gone mostly into the motor truck and bus end of the industry will be relatively unaffected by the turn of events since

heavy duty vehicles are in the category of defense. In fact a number of the most important producers in this field have swung practically all of their facilities exclusively to defense contracts.

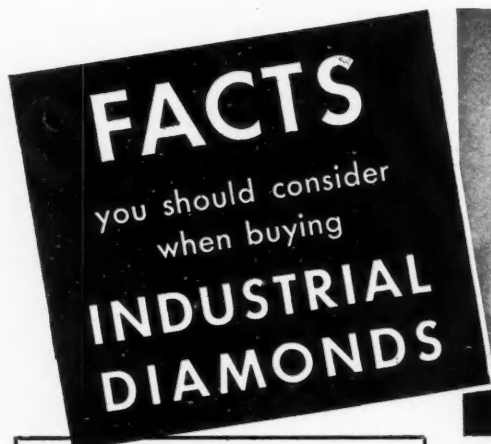
Perhaps the most important pronouncement affecting the parts industry is found in the public statement by Leon Henderson to the effect that the replacement end of the business would be given preferential treatment. In effect this has been interpreted as meaning that those companies who make only replacement parts would be permitted to continue without restrictions while those whose business includes both original equipment and service parts would be unrestricted with respect to service parts activity.

To facilitate this, the service parts industry would be granted priorities on the materials they need. The fly in the ointment is the fact that so little material has been left for civilian use that many of the small producers have been starved for materials right from the start. Presumably one of OPACS' jobs is to see that the available store of materials will be apportioned more equitably all around.

Much has been said about "alternate" materials in recent months. Actually only a few clear cut decisions have been made—and these only with respect to critical materials such as aluminum, zinc, nickel, and a few others. The difficulty is that the materials situation is changing day by day, making it humanly impossible to establish a stable program. This does not imply that the motor car manufacturers have not studied the matter exhaustively. The fact of the matter is that every user of materials today has lined up from one to a number of "alternate" materials in their order of importance and each one is prepared to make the substitutions if and when necessary.

As you go down the line on substitutions, you meet problems here and there that are hard to solve. For example, take exhaust valves. Many engineers now feel that if they can have at least 2 per cent of nickel in a high chromium nickel valve steel, that will take care of the exhaust valve situation quite satisfactorily. Actually only a small amount of nickel is needed per car to make it run. But if nickel is reduced too much and if the use of chromium is restricted, that may be enough to stop the building of motor cars.

Early this year, the uninformed as well as some who knew better, were plugging plastics as the materials that would solve the general materials shortage. Smoking-car designers were substituting plastics for any given material now in use. Actually the plastics industry is booked to capacity for defense and for civilian uses. Moreover, we are told by an authority that the machine capacity of the entire plastics industry is only 200,000,000 lb. per year. But superimposed upon these factors is a new development. OPM finds that many of the chemicals used in the making of plastics are required for

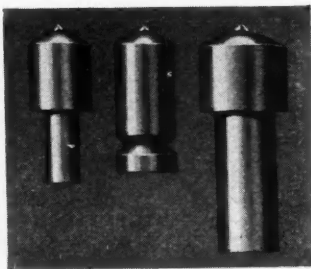
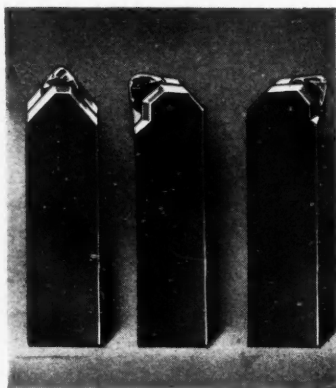


1. The kind of work to be done
2. The type of Diamond best suited to the job
3. The Market Value of such a Diamond
4. THE REPUTATION OF THE DIAMOND SELLER

Unless you're an expert on the many grades and uses of Industrial Diamonds — beware of "bargains". There are many different qualities and each should be priced according to its value. Deal only with established, reputable firms—skilled in the selection, setting and applications of diamonds—who will advise honestly on the quality, value and correct use of their products.

You needn't be an expert to safely buy diamonds from Anton Smit & Co.—for over 30 years specialists in Industrial Diamonds and Tools. Rely on this reputation and

experience to guide you in the proper selection of your diamonds. Consult us on your needs. Send blueprints of special shaped tools for quotation. Write for detailed, illustrated folder.



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LEONARD J. A. SMIT, Managing Director  
24 STATE STREET - NEW YORK, N. Y.  
TELEPHONE: BOWLING GREEN 9-0616  
IMPORTERS OF INDUSTRIAL DIAMONDS—BORTZ, CARBONS AND BALLAS.  
MANUFACTURERS OF ALL KINDS OF DIAMOND TOOLS.

munitions manufacture. In fact a large group of the plastics, including the phenolics and formaldehydes and others are being earmarked and users are being asked to seek other formulas. This in itself will serve to limit the extent of new applications.

Another drastic move being studied by OPM is the possibility of eliminating the aluminum now used in steel mills in the manufacture of "stabilized" deep drawing stock for fenders. Considering the rapidly growing facilities for the production of aluminum this is a rather radical step to take, particularly when it requires only from three to six pounds of aluminum per ton for this purpose. If the deep drawing properties of fender sheet are nullified, the whole process of making the modern fenders will have to be revised. The only alternative, short of restyling the new models is that of making the fenders in several smaller sections and welding them together. But even this alternative would involve some new die equipment and would make it necessary to introduce new processes and new equipment. It seems a rather high price to pay for saving only a few pounds of aluminum.

Labor displacement in the midst of plenty will naturally follow restrictions of output in the automotive industry. Labor displacement is a natural corollary no matter how the situation is handled at this time. The only possible solution is that of negotiating defense contracts immediately. Even this will introduce temporary dislocations due to the time consumed in tooling up, but it is the only possible solution. Doubtless some workers will be absorbed by defense industries seeking men at the moment but the majority of those laid off will have to wait until the new wave of defense work begins.

Certainly some workable method of distributing materials among producers of civilian durable goods is essential if we are to protect the interests of the small manufacturers.

OPM is developing a set-up for studying defense contracts and for spreading such contracts more widely among manufacturers who have the needed machine facilities. Producers in the automotive industry must establish immediate contracts with this department not only in the interest of national defense but for the preservation of their own business. Only quick action will preserve the integrity of automotive producers and prevent chaos in many small communities whose economy is built around the prosperity and employment opportunities offered by automotive producers.—J. G.

### Smithsonian Exhibit

Photographic presentation of the \$2-billion defense job of the automobile industry, ranging from tanks to bombers and from shells to submarine engines, is being displayed at the Smithsonian Institution in Washington. Also included is one of the midget trucks for military reconnaissance.

## You can be sixteen again ... tonight!



Mr. and Mrs., shed those cares of office and home. Drive to a nearby hotel for a leisurely dinner. Dance again. Stay overnight. Let us send up your breakfast. Enjoy having others wait upon *you* for once. Sounds a little crazy—but it isn't. It's an idea worth trying if you have a spark of adventure smoldering within you. Be sixteen tonight! What do you say?

AMERICAN HOTEL ASSOCIATION



**EVERY DAY IS FATHER'S DAY—**Traveling doesn't tire when you stop at a hotel. Hotel conveniences add hours to leisure time, give you a chance to rest and relax in comfort.



**STOP TO SHOP—**Some day, Mother, when you have a lot of shopping to do, stop at a hotel. Break up your shopping hours, rest your feet between times. Dine at the hotel.



**HAIL TO THE CHIEF—**Little dinners or big ones—for the boss, an honored guest or friend—"go off" much better in the atmosphere and service of a hotel. Hotels give food a lift.



The Sign of a  
Recognized Hotel

for a fresh **START**  
**STOP** at a **HOTEL**



## Million Dollar Program Advances Production of Cummins Engine Co.

(Continued from page 25)

circumferentially.

The outside surface of the cup is polished, while the tip is honed with a very fine stone to remove the slightest burr raised by the drill. Cups are also treated with Pentrate to prevent rusting.

Assembly of injectors is done in a room entirely isolated from the ma-

chine shop. To prevent accumulation of dust or dirt particles on the finished injector parts, all air in this room is thoroughly filtered and no metal cutting is permitted—not even the use of files or oil stones. Every piece is carefully washed before entering the assembly room.

The laboratory facilities are excep-

tionally well suited to the gamut of chemical, metallurgical, and materials testing activities of a large manufacturing organization, provide the means for carrying on the developments of a constantly improved product. It is of interest to find that these facilities are earmarked exclusively for research and experimental work.

Six test cells are provided for engine dynamometer testing, so arranged that a bank of two test cells communicates with a common gallery containing the remote controls and recording instruments for each dynamometer. During the progress of the engine runs, the observer is stationed in this gallery, viewing the test cells through a safety glass window. The instrument panels contain a variety of gages, covering the following functions—lube oil pressure, water and air pressure, pyrometer, potentiometer, recording thermometer for crankcase oil, water temperature, and fuel consumption equipment.

Supplementing the dynamometer test cells is a separate refrigerated chamber or cold room equipped for cold-starting research. This was installed by the York Ice Machinery Co., originally designed for maintaining a temperature of minus 30 deg. Fahr., but operated regularly to as low as minus 50 deg. Fahr.

A large central section is devoted to experimental machine shop work where many of the special parts for new engines are completely machined. Equipment includes—lathes, milling machines, a jig borer, external and internal grinders, bench lathes, drill presses, etc. In a corner of the front end of the building is the assembly department which affords facilities for studying the assembly problems of new engine models as well as for the assembly of experimental engines for testing.

A completely equipped chemical laboratory is housed in the rear of the building.

Metallurgy and materials testing have been given special emphasis. One of the finest pieces of equipment to be found anywhere is the hydraulically operated 200,000-lb. Baldwin-Southwark tensile testing machine equipped with a remotely mounted stress-strain recording attachment. The illustration shows the testing of a 1¼-in. bar of S.A.E. 4130 steel which failed at 165,000 psi.

Other equipment in the metallurgical laboratory includes—the latest type of Bausch and Lomb ultra-microscopic camera; three hardness testing machines, an impact tester, a Shore monotron, Rockwell and Brinell testers. In addition, there are three heavy duty electric furnaces for experimental heat treatment.

Latest item set up here is a new Krause testing machine for accelerated fatigue testing of valve springs. The test machine includes a Strobotac for observing the behavior of the springs while under test.

## Billions for Defense

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And our guess is that it will probably make, in 1942, more than 2,000,000 automobiles for civilian use, in addition to the needed replacement parts for the essential 85 per cent of our registered 30,000,000 highway transportation units.

What the automotive industry has contributed to the national defense to date, and how it has done the tremendous job that it has done, will be told in the

### Production for Defense Issue of AUTOMOTIVE INDUSTRIES

*to be published October 1*

The issue will also show the size and character of the job ahead, listing, among other things, the great mass of new orders that have been placed and the companies to whom they have been awarded.

The Advertisers' Index will be a veritable Roll Call of the Leading Suppliers to the industry.

Obey that impulse—for position's sake—and make your space reservation now.

**CHILTON CO., Chestnut and 56th Sts., Philadelphia**



## Defense Production at Timken

(Continued from page 37)

tools. As mentioned earlier, Timken has had a considerable amount of experience with the procedure of heavy roughing cuts on steel and has had ample opportunity to develop the most efficient utilization of cemented-carbide tooling of this nature consistent with the rigidity and speed of existing equipment. In addition to the cases mentioned earlier, we might mention a few additional examples of Ramet perform-

ance. One is a steering knuckle forging of SAE 3135 steel, of 331 Brinell hardness. This is roughed out on a Model R Lo-Swing lathe with a depth of cut of at least  $\frac{1}{4}$  in. Another is the steering knuckle drive flange, a rather large forging of SAE 1040 steel, with a hardness of 300 Brinell. This part is machined on Potter & Johnston turret lathes.

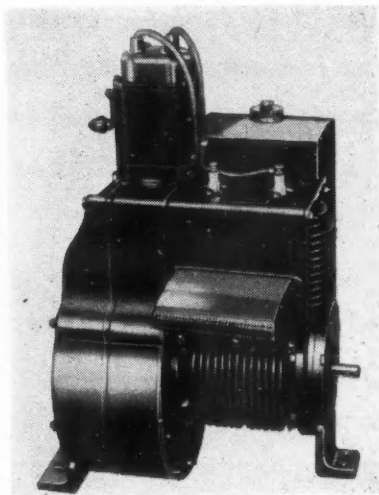
Other cemented carbide tools such as

Firthite and Carboloy are used for machining the pinion bearing cage and differential cases, both of malleable iron. Other parts of steel forgings are machined with Ramet.

As can be seen by this article, Timken has made use of new equipment with modern cutting tools when available, and when not available, within a reasonable time, has utilized existing equipment by ingenious motion fixtures. This example of "horse-sense" has enabled them to complete defense contracts in the shortest possible time.

## Mercury Universal Portable Industrial Engine

Three new two-cycle, portable, air-cooled industrial engines, recently placed on the market by Kiekhaefer Corp., Cedarburg, Wis., are being recommended for use with chain saws, pumps, generator sets, fire-fighting equipment, compressors, garden tractors, power lawn mowers, motor boats, etc. The line consists of a single-cylinder 2 $\frac{1}{2}$ -hp., two-cylinder 5 hp., and



Mercury two-cycle, air-cooled industrial engine

four-cylinder 10-hp. engine. Being of the two-cycle type, they have few and simple working parts and are relatively light in weight. The 5-hp. model, for instance, with clutch and transmission, weighs only 70 lb.

These engines can be used on either a vertical or horizontal position, as desired, and may be had complete with clutch, in various gear ratios, and with several transmissions. They have an industrial-type magneto, instead of the flywheel type more commonly used with engines of this size. Multi-cylinder models have individual cylinders. The engines may be throttle- or governor-controlled, depending on the application. Their cylinders are cast of aluminum alloy in a single piece, and are diamond-bored and lapped.

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# 2 Old Favorites become to give you **FASTER** and

Here's news for steel parts producers—news of important changes in Union Freecut and Union Supercut Bessemer that make *new, improved* steels of these two good, old standbys.

Favorites for years, because of their uniformly high machinability, remarkable freedom from tool-wearing abrasives, and all-around

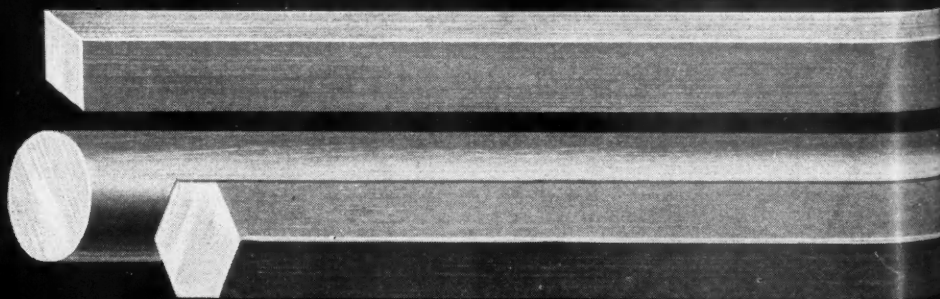
soundness, these well-known steels in their improved form now permit faster and better production of steel parts than was ever before possible.

Here is **WHY** and **HOW** they have been changed!

To cooperate with the steel industry's program of simplification and standardization of steels to speed production for both National Defense and civilian needs—and in keeping with Union Drawn's half-century old policy of constant improvement in the interest of increased machinability—Union Freecut and Union Supercut are now being manufactured to new standards.

The sulphur content of both steels has been increased to higher minimum and maximum limits to promote machinability. In addition, both steels are being manufactured to a more restricted range to insure more uniform machining results.

Production and processing of both of these improved analyses will follow the lines developed through Union Drawn's many years





# **2 New, Improved Steels**

## **BETTER parts production!**

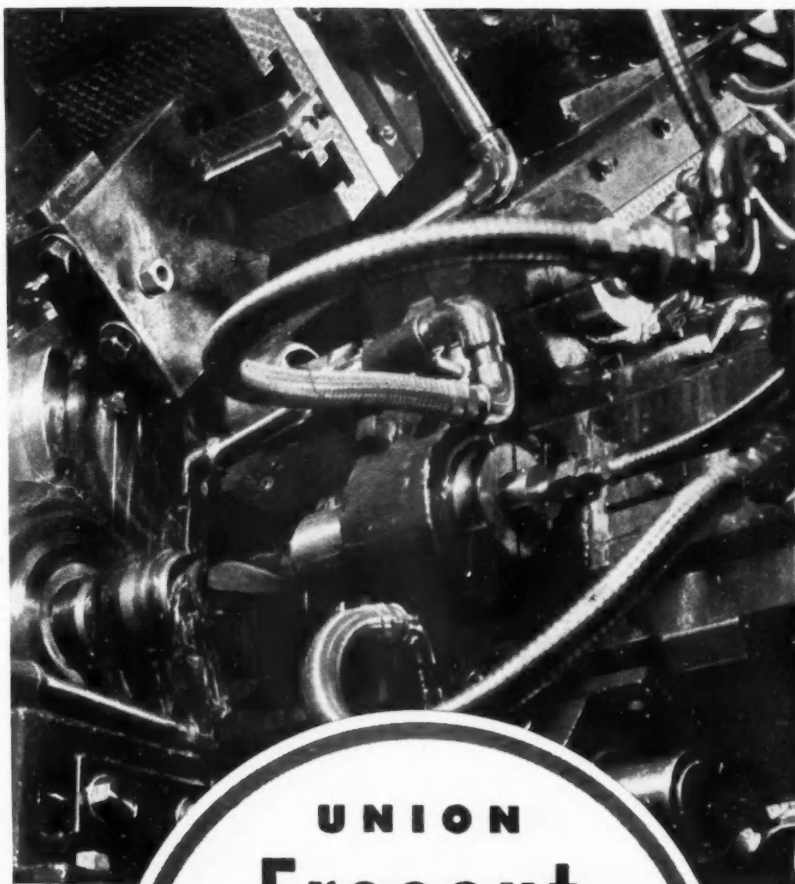
of study and research into the problems of machinability, thus assuring retention of the many desirable qualities which gained universal preference for the old Freecut and Supercut.

This means that parts producers who have been using these two steels will find in the new Freecut and Supercut improvements in machinability that will assure higher sustained production schedules, that will further reduce wear on cutting tools, that will produce finer machined finish than was ever possible with these steels in the past.

These changes in chemistry will in no way affect the physical properties or cyaniding and carburizing qualities of these two new steels. You can expect—and will get—the same strength and the same heat-treating results as you have obtained with S.A.E. 1112 or with S.A.E. X-1112.

In addition, these changes will have the desirable effect of placing us in a better position to meet your requirements for Bessemer screw steel.

If you have been using S.A.E. 1112, we recommend that on all future specifications, requisitions and orders, you change to Union Freecut. Should you be using S.A.E. X-1112, we suggest that you change to Union Supercut. Union Drawn Steel Division, Republic Steel Corporation, Massillon, Ohio.



UNION  
**Freecut**  
★ ★ ★  
UNION  
**Supercut**

## Speed Regulators for Dynamometers

(Continued from page 29)

equipment, which would result in loss of time in restarting and waiting for conditions to become constant before proceeding with the run.

The voltage drop across the armature resistance determines the relative polarity of the grids of tube G. This polarity changes with the direction of current in the armature circuit. When generating, the right-hand grid is positive with respect to the left-hand grid,

as shown in the sketch. Current flow is confined to the plate nearest this grid. Excess armature current causes increased plate current, with a lowering of  $E_c$ , which lowers the thyatron bias  $E_t$  and weakens the field. This presupposes that the regulator is operating to maintain speed. The limit of field weakening depends upon the setting of the current-control rheostat.

When motoring, the left-hand grid

is positive, and the tube operates on high armature current to lower the grid voltage of tube E. This raises potential  $E_{t2}$  and increases the field current to the maximum, if necessary, regardless of whether the regulator is operating to regulate current or speed. When the disturbance is of such violence that even full field will not correct it, the armature current will continue to increase until the dynamometer is disconnected from the line through the action of the overload relays in the regular control circuit.

### Combination Regulators

For combinations of direct current and inductor dynamometers, two regulators are used, one for each field. It is possible to load each unit to its full capacity by independent control of current in each field. Speed regulation, acting through the regulator of the direct-current unit, maintains speed by changing the field of that unit within the limits of allowable armature current. The second regulator, operating on the inductor-dynamometer field, is actuated from current change in the direct-current dynamometer armature. As the armature current approaches a preset value, the additional load is taken by the inductor dynamometer. In effect, the direct-current-dynamometer regulator controls speed, and the inductor-dynamometer regulator limits current in the direct-current-dynamometer. The current-limiting feature operates in the same manner for speed regulation and manual control. With manual control, the complete range of load of the combined dynamometers is obtained by the operation of a single rheostat.

The combined equipment lends itself readily to "pump back" operation of the direct-current dynamometer. Engine-ignition failure (and hence loss of power) tends to transfer the load of the inductor dynamometer from the engine to the direct-current-dynamometer, which immediately swings to motor operation. The regulator operates, first, to unload the inductor dynamometer, and next, to limit current in the direct-current dynamometer, which is operating as a motor.

### Control

Control problems have been simplified by the use of regulators. Conventional control always has required considerable space adjacent to the dynamometer, even though resistors and contactors may be located at a distance. Regulators of the type described offer the advantage of the use of miniature control panels in shapes and sizes convenient to the over-all arrangement of other testing equipment. Figs 5 and 6 illustrate a master panel and its associated contactor panel for a combined direct-current and inductor-dynamometer. The master panel is designed to meet a particular space requirement for an engine test stand. The dimensions are 32 in. high by 24 in. wide by 8 in. deep. Large contactor panels are



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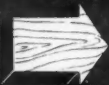
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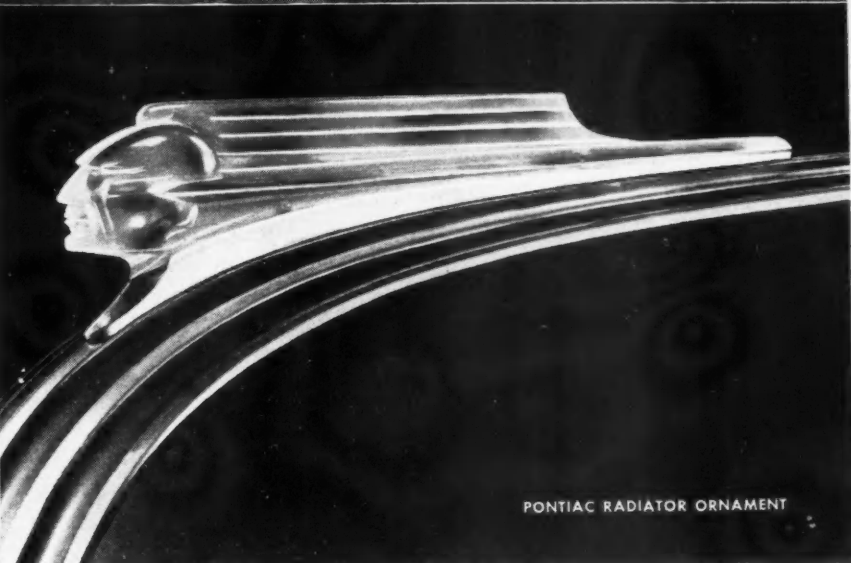


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## LUCITE for Automobiles for Airplanes

### A STATEMENT BY DU PONT ABOUT PLASTICS

Defense requirements and unusual commercial demands exceed the supply of some Du Pont plastics. National Defense orders will get preferred attention, of course. But Du Pont is bending every effort to satisfy commercial replacement needs. Shortages of equipment and raw materials necessarily limit this effort.

Du Pont is also instituting a broad research and development program. We believe that from this program will come improvements in existing plastics and the creation of entirely new types with new and valuable properties.

Stories of Du Pont plastics applications and new developments will continue to appear in advertisements. We hope you will find it helpful to apply this information to your present and future needs. Meanwhile, experienced Du Pont technicians stand ready to devote their knowledge and facilities to your product problems.



located adjacent to the absorption resistors at some distance from the dynamometer.

Other designs include long, narrow panels for installing under the window of a test chamber, and the combining of dynamometer control parts with engine test equipment for greater convenience to the operator.

Where a regulator is added to an existing installation, the rheostats of

the regulator can be mounted in a small, portable box and arranged for connection to the regulator by flexible cable; or they can be permanently installed on the existing panel. A knife switch installed at the existing panel provides a means for quickly disconnecting the regulator from the panel. By providing a suitable portable mounting for the regulator and auxiliary equipment a single regulator can be used at several test stands.

and the Clipper models: 7.00—15; while the long wheelbase models have 7.00—16 tires.

On the Six and Eight, the weight of the four-door sedan has gone up a little due to heavier body. On the Six the shipping weight is 3415 lb., curb weight 3550 lb. On the Eight, shipping weight is 3610 lb., curb weight 3750 lb. The Clipper Super 160 has a shipping weight of 4025 lb., curb weight of 4190 lb. The Clipper Super 180 has the same shipping weight and curb weight as the 160.

## 1942 Packard

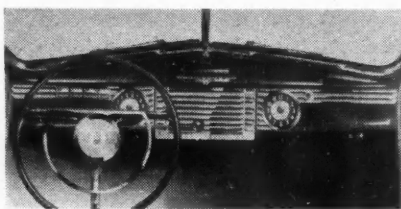
(Continued from page 30)

ferrous pistons, the mains and rods will have the new heavy-duty thin high-lead babbitt bearings.

The same transmission is used on all models. The Six and Eight have the same axle formerly used on the Six. It has a standard gear ratio of 4.3 to 1 on the Six and 4.1 to 1 on the Eight. Optional ratios of 4.55 to 1 on the Six and 4.3 to 1 on the Eight are supplied with overdrive equipment. Electromatic drive is offered as optional equipment on all models.

The brake set-up on the Six and Eight has been changed to 12 x 1 3/4 in. for the front, and 11 x 1 3/4 in. for the rear. Brakes on the Super are 12 x 2 1/4 in. for the front, and 12 x 2 in. for

the rear. The wheel set-up has been materially changed. Tire sizes run as



The new Packard custom 180 instrument panel

follows: On Sixes and Eights: 6.50—15; on the Supers, the convertible coupe

## Wider Laminum Shim Stock Now Available

Sheets of Laminum shim stock measuring 7 by 36 in. can now be obtained from Laminated Shim Company, Inc., Glenbrook, Conn., in addition to the 6 by 36 in. sheets heretofore produced. The new width enables the company to manufacture larger jointless shims, and it affords the same convenience to purchasers of shim stock who cut their own shims. The new sheets are available in over-all thicknesses varying from 0.006 to 0.125 in. All thicknesses may be obtained in all-laminated sheets, with a choice of 0.002 or 0.003 in. laminations, or various thicknesses may be had partly laminated and partly solid.

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